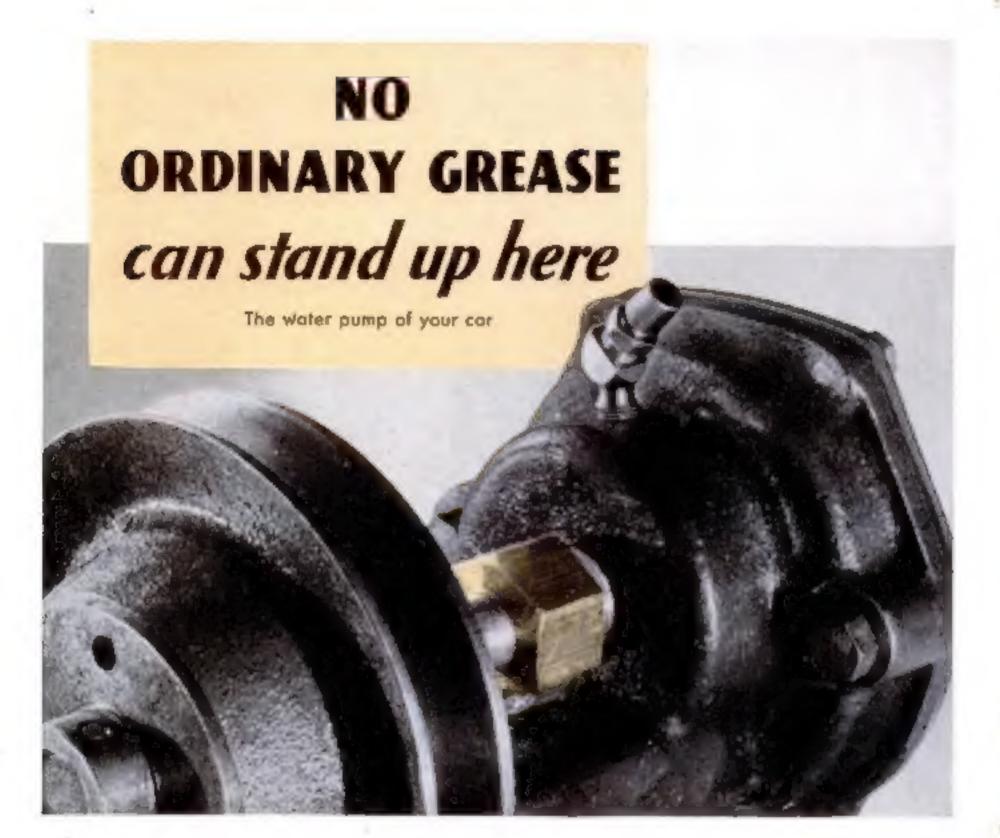


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POPULAR SCIENCE

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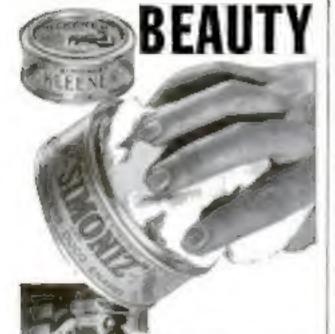
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In This Issue—Hundreds of Fascinating Articles Tell the Latest News of Laboratory Discoveries, Scientific Triumphs, and Amazing New Inventions

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Money...

WHEN YOU NEED IT MOST

By LEON MEADOW, Financial Editor

T HAD been a good dinner Francis Gordon reflected. But then the Barringers always served good dinners, he remembered.

Norman Barringer came back into the living room. "Now that I ve put the girls to work in the kitchen," he said to his guest, "we'll have time for a quiet little chat before the bridge war begins. I wanted to ask you something oh yes, I remember now. Tell me, Francis, what's all this I hear about Financial Independence Week? I've seen some posters ballyhooing it—but what is it?"

Gordon lit a cigarette before answering, "All the life insurance companies in North America have joined forces in observing a Financial Independence Week, from April 15th to 22nd, for the purpose of widening public understanding in its fundamentals."

"Life insurance companies?" questioned his host.

"Why not—who has a better right to undertake that necessary job? Few, if any, other types of financial organizations in the world can match the record of life insurance companies in 1932. They paid policybolders and beneficiaries over three billion dollars in 1932 and, I am told, had over one hundred billion dollars worth of life insurance in force for that same year. So I guess they can speak about financial independence with authority.

"As you probably know, financial independence doesn't necessarily mean a lot of accumulated money. But it does mean a secured means of living for life, and it doesn't matter whether that living is gained by a weekly salary check, by inberitance or by the home production of all one's necessities."

"Don't you feel," interrupted Barringer,
"that there's a good deal of irony attached to a Financial Independence Week
promoted in these times?

Gordon laughed. "I hadn't thought of it in that way," he replied. "What I do know is that these hard times have made one thing apparent—and that is that now, more than ever before, a man can't afford to die!"

"That's a peculiar thing to say," put in Barringer. "What do you mean—'can't afford to die'?"

"I MEAN simply that it doesn't pay to die, from any angle you look at it. If a man has accumulated a large estate in bonds, stocks, real estate properties or in all of them, his death at present would leave his family with a sadiy and badly depreciated estate. Not that that would

always be the case," Gordon added hastily, "for the picture may well change in the future. But the only way he could make sure of keeping that estate at 'par' now would be by taking out sufficient life insurance to protect and balance losses through depreciation, and thus safeguard his program of financial independence.

"Or, if you want, take the case of the man who is the wage-earser or income producer for his family in these times. He 'can't afford to die.' for survival is hard enough with him living. In normal times his family might be able to produce sufficient income for their livelihood. To-day that is next to impossible. They must be protected, and the cheapest, safest way is through adequate life insurance, or so it seems to me."

"Say, Francis, excuse me for interrupting, but you're quite an enthusiast on the subject, aren't you?"

"I've been giving it a lot of thought lately, and I've heard some interesting

"Have you reached any conclusion?" Barringer asked his guest.

"ONE major one—a soldier lan't a veteran, isn't really proven until he's been under fire. He may drill nicely and all that, but the real test comes when he swings into action. Investments are like that, too, In dress rehearsal, most of them have a way of sounding and looking fine. But delivery under pressure, under adverse conditions is another

What I'm driving at is that life insurance has come out on top, has proven its value 'under fire!' What's more, I think it will emerge with new laurels. Did you ever stop to consider that most men, including myself, have always thought of life insurance as a purely future protection—as what you might call a second line of defense?"

"I've regarded it that way, too." his host replied

"Well, I've had my eyes opened, and I'm changing my ideas on the subject. It seems to me that present conditions have proven for life insurance the claims that have long and truthfully been made for it. Namely, that it is first-rank protection. Men, families and businesses in varying situations are learning that life insurance, originally purchased as a purely secondary and future means of revenue, is actually enabling them to live, to keep going today; is actually a source of income now—when they need it most.

"I heard a (Continued on page 6)

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\$200 A MONTH REWARD

for taking this sensible step

FITH a reward of \$200 a month for life, you can retire whenever you wish. You can sit back and take life easy with many happy, comfortable years shead. Or you can go on to larger success, knowing that your guaranteed income sets you free to do as you please.

In either event, you will be very thankful for the sensible plan you discovered back in 1933 - and for the simple step that started you on the way to such a rich reward. Fortunately, you don't have to be rich to start on the road to this security. Far from it. Thousands of men of comparatively limited means have used this plan to get rid of their biggest money worries for good.

It is called the Phoenix Mutual Retirement Income Plan, And it provides a permanent monthly income, beginning at any age you say, 55, 60, or 65. The amount of the income can be \$100, \$200, \$250 a month, or more-any amount you wish.

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And when your income begins, nothing can stop it. Nothing can delay it or interfers with it. Both the plan and the income are guaranteed to you by the Phoenix Mutual, an old established Life Insurance Company with a record for fulfilling promises which began when this company began (back in 1851).

These Benefits are Yours

If you wish, other important benefits may be included in your plan. You can provide a guaranteed income for your wife, in case anything happens to you. Money for your children's education.



Money to leave your home clear of debt. Money for other pressing needs or emergencies, such as serious accident to you or illness.

A Depression-Proof Plan

A Retirement Income Plan is an ideal arrangement for the man whose financial progress has been upset by the depression. Naturally he doesn't want to repeat his experiences and, in the future, he wants to put most of his money where it will be both safe and accessible.

The minute you put your plan into effect, a great burden is taken off your shoulders. As you continue to invest, you can laugh at depressions and other things which now cause money worries. Others may lose their wealth. Great estates may crumble. But this plan unfailingly brings you your reward.

The plan is as safe as the great institution of life insurance itself. It is based on the same principles. It has the same safeguards. Every possibility has been considered. Every reasonable precaution has been taken. Even if you became

totally disabled for six months or more, you would not need to worry. Your payments would be made for you by the Company out of a special fund provided for that purpose.

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Think what a Retirement Income Plan can mean to you! Protect your future? Certainly, but think what it means to you now! Once you have adopted it you are financially free. A great load is off your mind. Many of your biggest money worries disappear,

There is no mystery to it, no complications. It's all clearly outlined in an interesting 24-page booklet explaining

what this plan can do for you. Send for your free copy today. No cost, No obligation.



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Why rope em when you can dope 'em?



NO WONDER that cow was cowed! Brother, there isn't a steer in Texas that could stand up usder the fumes of that smudgy smokel

But that's the only good argument we ever heard for strong, heavy tobacco in a soggy pipe. Every man in the row punching game-and out of it—should smoke good, mild tobacco in a well-kept pipe. Take Sir Walter Raleigh's Burley mixture, for example. There's a smoke that's as mild as a prairie evening, but there's flavor in it ... rich ... full bodied ... satisfying ... and kept fresh in gold foil. On your next trip to your tobacco store make this resolution ... "Smoke the tobacco that has become a national favorite."

Brown & Williamson Tobacco Corporation Louisville, Kentucky, Dept. Y-35



It's 15 -AND IT'S MILDER

Money When You Need It Most

(Continued from page 4)

story the other day about a woman who was left a rather sizable estate in the form of a large lumber mill and some insurance. When times got hard her income from the mill grew smaller and smaller. When things got worse she found it necessary to dip into her insurance to cover taxes and mortgage interest on her business properties. Now the business is gone, and the insurance remains as her sole source of income. She never dreamed that would happen!

"Listen to this one. A corporation suddenly found itself chaked for money when bank bolidays in several states made it impossible for their branch offices in those states to operate. They fell back on their business insurance, originally taken out as a future protection only, and obtained a large enough loan to tide them over. Once more insurance, under pressure of hard times, stepped up to the front line of financial safeguards."

"That's a good way of looking at it,"

commented Norman Barringer, "It hadn't occurred to me before, but now I begin to see a reason for your enthusiasm. The case for life insurance is certainly a strong

"And so," replied Gordon, "to go back where we started, the case for life insurance's part in Financial Independence Week is also a strong one. You see, the depression has finally had the effect of interrupting most people's financial programs and, in many cases, upscitting them entirely. From the two isolated stories I gave you-and, by the way, they're typical of thousands-you can see that insurance is being regarded in a new and stronger light. More and more people are signing their own Declaration of Financial Independence these days by putting their names on life insurance policies, particularly of the retirement income and annuity types. I don't think they'll regret it. Say, here come the girls, and we haven't set up the bridge table!"

TO HELP YOU GET AHEAD

THE booklets listed below will help every family in laying out a financial plan. They will be sent on request,

The Investment Aspect of Life Insurance, by M. A. Linton, presents life insurance as an exceedingly worthwhile investment as well as a form of protection. Provident Mutual Life Insurance Company, of Philadelphia, Pennsylvania, will mail a complimentary copy upon request.

Before 65 and After explains the full details of a Retirement Income, with full Life Insurance, Disability and Double Accident benefits. Sent on request by The Equitable Life Assurance Society, 393 Seventh Avenue, New York

How to Get the Things You Want tells how you can use insurance as an active part of your program for getting ahead financially. Phoenix Mutual Life Insurance Company, 328 Elm Street, Harrford, Conn., will send you this booklet on request.

Dependable Security of Legal Reserve Life Insurance as a Depository Institution-by S. S. Huebner, prominent insurance expert, sells why life insurance can show you how to face the future unafraid. Sent on request by Financial Independence Committee, 140 Garden St., Harrford, Conn.

"You Can Have An Income As Long As You Live," a booklet describing simply and clearly how the Annusty can be used to provide a guaranteed income for life. A copy will be sent on request to Inquiry Bureau, John Hancock Mutual Life Insurance Company, 197 Clarendon St., Boston, Mass.

STRENGTH OF INSURANCE COMPANIES REVEALED BY 1932 STATEMENTS

Maximus who are policy holders in the insurance companies advertising in this magazine should be interested in seeing the 1932 annual statements of these companies. In general, these statements indicate a secure, sound basis of stability, and are a tribute to the wisdom and integrity which insurance companies have used in safeguarding the interests of their policy holders.

We have made arrangements with the

DEADERS of POPULAR SCIENCE Equitable Life Assurance Society, Phoenix Mutual Life Insurance Company, and Provident Mutual Life Insurance Company for the distribution of their 1032 annual statements to readers of POPULAR SCIENCE MONTHLY.

If you wish to have a copy of any or all of the statements by the above companies, address your inquiry to Financial Department Popular Science Monthly, 381 Fourth Ave., New York, N. Y. Your request will be answered promptly.

OUR SHIP MODEL KITS WILL START YOU ON A FINE NEW HOBBY

SOLEN HALLS IN THE STREET

THERE are few hobbies—not even working out picture puzzles—that will give you so many bours of pleasure at so low a cost in the long run as building ship models. Thousands of Popular Science Monthly readers have found this true in spite of the fact that they had no previous knowledge of ships or of model making when they started to construct their first model from our plans.

Now, however, we have made it still easier to begin this hobby by providing construction kits of carefully selected materials. You no longer have to do a lot of "shopping around" to get what you want, and it is not necessary to buy excessive quantities of material or try to

use unsatisfactory substitutes.

Two kits are especially recommended for beginners. One contains all the raw materials (except give and paints) for building the beautiful model of the Elizabethan galleon Revenge illustrated on pages 67 and 88 of this issue. The kit is further described on page 88. Picturesque as this model is, the construction is not difficult. Do not be deceived by the costly and elaborate appearance of the finished model as it appears in the photographs mentioned. Capt. E. Armitage McCann, who designed it from original historic sources, kept in mind the needs of the beginner at every stage of the construction, and be used all the resources of his many years' experience to simplify the various details including the rigging to such a degree that the inexperienced model maker would find the work relatively easy. Each hit is accomparted by four blueprints showing all parts full size. These alone would cost \$1 if purchased separately.

The second kit that has been designed chiefly for beginners contains the sawed out hull and materials (except paints) for a 12 in long miniature model of the new American liner Manhattan. It is illustrated on page 88. Because it is so very small and simple, the model can be made on the kitchen table—or in the living room, for that matter—with a pocket-knife, a safety maor blade, a pair of small-nosed pliers, a file, and, if available, a fret saw or jeweler's saw.

Popular Science Homecraft Guild, 381 Fourth Ave., New York, N. Y.

□ Materials for building a 25 in, long model of the naileon Returnes, for which I enclose \$5.75 (or \$7.15 with the hull blocks fully shaped)

Materials for building a 12-in, miniature model of the liner Blankattan, for

which I coclose \$1.00

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P3.11				

(Print very clearly)

Note: The Krurnye kd is 50 cents higher west of the Musissippi River because of heavy shipping charges. If desired C. O. D., there will be on extra charge of 18 cents. The Mankoviga kit is not sent C. O. D.

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Tire first, lose cost on an Old Town Canne is the hast cost for many season. Hand me down't haven it. Months out of source won't should it or crack it. There are no eigenste it out no up-keep costs. Old Town are best to last. Tough, light reduc hall is overred with downlie, non-leak canvas.

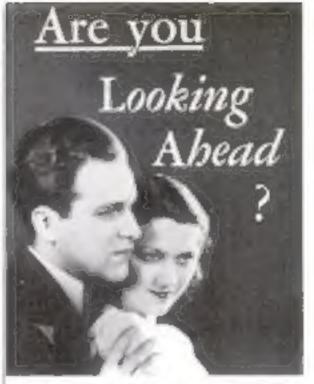
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9

"We were ready to sell our house. It got so stifling hot in summer—and was almost impossible to heat in winter . . . We didn't know what to do until we read your book."

-A TYPICAL USER

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"WE had never stopped to think that the walls of our house were hollow, nor that heat—and cold, and even drafts—passed through them like water through a sieve.

"We knew the aftic got stilling in the summer, but we didn't know how that heat got into the bedrooms so easily.

"And we never even guessed that a fireproof woo!, made from rook, could be 'blown' into those hollow walls and empty attic spaces... and would protect us against heat and cold as effectively, to quote your book, 'as a stone wall 10 feet thick,'

"A year ago we put in J-M Rock Wool Insulation—throughout! Our fuel bills dropped 22%. The house could really be kept warm and free from chilly drafts all winter. And last summer it stayed 15° cooler than outside—even upstairs?"

The booklet below tells how J-M Rock Wool Insulation will save you money—make your home more comfortable. Mail the coupon for this booklet and full details of the J-M Deferred Payment Plan—now!



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Our Readers Say

Cold Storage Experimenter Is in Need of Victims

Is a fish can be frozen, put in storage, and brought back to life, what prevents the same process being applied to all species, including human beings? Think of the possibilities! Instead of putting laid-off workers on the retired list, we would put them in cold stor-

age. Also, goodby suicides! Anybody that can't stand living in 1933 need simply order himself put on ice for ten, twenty, or thirty years. Technocrats, farmers, husiness men, fugitives from justice — hundreds of thousands of people would be ready customers. There's mil-



lions in it. All it needs is a little capital and a few radio crooners for experimental purposes.—J. E. McL., Massillon, Ohio.

He Had a Grand Time Building an Electric Fountain

In connection with your article on electric fountain, contained in a recent issue, I offer the following idea: Popular Sci-ENCE MONTHLY can start a contest for the the best fountain and as a help to contestants, give directions for making a waterfall scene which I made some years ago. It is really more fun to make than a ship model. The frame can be made of heavy wire over which is bent wire fly screen, and cement stucco moulded into the shapes desired, or real rocks can be used. I used a pure white waterproof plaster, which is much better than ordinary cement for fine work. Indentations can be made to bold growing plants. Many stores are now selling figures of men and animals which are just suited for a waterfall and a real forest scene. -F. H., New York, N. Y.

We're Surprised That You Were at all Surprised

I have just finished looking through a recent issue of Popular Science Minerally and have been agreeably surprised. In addition to your interesting articles on Surgery, Microscopy, Chemistry, etc. there is another of L. F. Merrill's excellent how-to-make-fit articles. His detailed instructions on how to

make mocrasins and a woodsman's pack which appeared in 1932 issues of your magnaine, plus this month's information on how to make snowshoes, are three things that should be in every outdoorsman's strap book. After searching for years in books and



magazines for such instructions, and then finding them in your magazine has made it all the more valuable.—D. M., Pittsburgh, Pa.

Maybe This Is the World's Smallest Coal Mine

Popular Science Monthly recently had an article on the world's smallest coul mine which was operated by als men. About a mile west of New Castle, Colo., on the site of the old Keystone mine which was run quite a number of years ago, a mine is operated now by three men. It is located about halfway from the top of a steep hill. A cable is stretched from the entrance to the bottom of the gulch on the opposite side, on which they have a large bucket-like contraption, that carries the coal from the mine to a large wooden box, where the coal is graded.—R. Y., New Castle, Colo.

Too Much of a Good Thing Is Bad Even for Fish

I was interested in a letter in a recent issue of Populan Science Monthly which appeared under the title, "Aspirin Works Miracle in a Gold Fish Bowl." Several years ago I was stopping at a hotel in Savannah, Ga. In front of the hotel was a small pond in which were a number of gold fish. In the morning all the fish were alive and active. At noon all the fish in the pond

were standing on their heads with noise in the mudat the bottom of the pool. Hotel employees examined the pond to find what was killing the fish. One of them found a tin aspirin box in the bottom of the pool. It was open and empty-



Was there any anjarin in the box when it was thrown into the water? If so, did the aspirin cause the death of the fish? You might try this experiment on your own gold fish.—G. P., New York, N. Y.

Coast Guard Academy Article Wins His Praise

THE article by Kenneth M. Swerey, about the Coast Guard Academy, was a corker. It should go a long way toward establishing the rightful glory of this branch of our military service. I'm glad Populas Screek Monthly was the first popular magazine to recognize the importance of the new school.

—D. L., McK., Forest Hills, N. Y.

Radio Beginner Pleads for First Principle Articles

I THINK that more readers of the POPULAR SCHNEZ MONTHLY are getting interested in radio every month. I know I am, but I do not know enough about radio thoroughly to understand the articles now published in that line, and I know a large number of other readers are in the same fix as myself. In each of two late issues that I have read,

three pages have been given to radio, Why not devote another full page or two, to the explanation in serial form, of the fundamentals of radio so that we beginners can take in the good articles now published. This is not a knock but a suggestion. I think your magazine is fine.—J. A. McA., Covington, Va.

Does This Solve Mystery in Speed of Light Tests?

I am greatly interested in the various surmises, published in Our Readers Say, in regard to the discrepancy in the recent light-

speed experiments. It seems to me that the most obvious reason for the difference in speed has been over-looked. The new experiments have all been conducted in a tube from which most of the air was pumped. As a result, the speed of light was increased by fifteen makes per

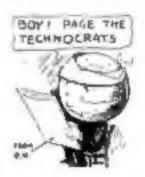


second. Doesn't that seem to indicate that the atmosphere has a greater optical density than the ether? I have long suspected this on account of the refraction of light as it enters the atmosphere of the earth. A simple way to prove whether or not this supposition is correct, would be to fill the tube with air and reconduct the tests. If the results were the same as those previously accepted, it would be conclusive proof that light travels inster in a vacuum than in air. If this turned out to be true all measurements based upon light years would be knocked out by something like 473,040,000 miles. What do others think of this?—W.W.A., San Francisco, Calif.

Probably Good, But It Sounds Slightly Involved

Our knowledge of chemistry and physics makes possible a plan for determining prices of commodities which I believe would be fale to everyone. Starting with gold in the ore, unmined, as a theoretical standard of value, let the price of each element in its ores or natural compounds be based on the relationship of gold to it in the periodic table. Let the theoretical price for gold in the ore be determined by subtracting from its price in bullion the average cost of its production. Most of the energy reaching the earth from

the sun falls on water. Water is perhaps the most important substance in the life of man and other forms of life. A relationship between a quantity of water and the quantity of heat necessary to evaporate it might be made the basis for a fixed price for



Tempropiles independ

energy. By adding the fixed prices for chemical elements contained in a commodity to fixed prices for energy contained and applied to the production and marketing of the commodity, a fixed price for any commodity can be set. Energy and property must both be considered to have value, for the man who has no property will need to exchange energy for property. Before he can do this, both energy and property must have prices. Changing prices are not fair since they do not change evenly.—R. H., Colorado Springs, Colo

Shallow Diving Suit Wanted by This Enthusiast

I AM enthusiastic for Popular Science Montelly, I enjoy the special departments such as the chemistry, home workshop, and suformobile W 5, of McAlstee, Okia, has

asked for an article on the construction of an altra-violet framformer and I also wish to put in a request. It is for an article on the construction of a shallow diving outfit which has no suit but just the heimet. Diving in shallow water is great fun and I believe a



small outfit made of scrap materials could be cheaply and easily assembled. An old copper hot water tank could be used for the helmet, garden hose for the air line, and an air pump obtained from an old automobile pump. These would supply the most pecessary materials, but even so some small difficulties hader one. An article by someone who has had experience with diving could no doubt, smooth out the difficulties, and add some necessary details.—J. C. N., Beach H. M., Mass.

Here's a Money-Making Plan If You Have a Camera

HERE is one "how to make money" idea, that is good. A friend of mine has a midget camera and he has an excellent way of making his camera pay He goes for a walk brough town and whenever he sees an interest ng scene he snaps it, olten without the knowledge of those photographed, which is regarble due to the small size of his camera. 5 met me it is a young mother with her first son watching toys in show window, sometime two business men having a short conference on a street corner or some of his friends wasking with their girls through the park, or a respectable citizen harrysne down main street, or merry faces of children funning from school. When the film is developed be ensarges the pictures into post card size and displays them in a show window. As far as I know every picture he has taken he has sold and many of them in large quantities. -P B West Aliquipps, Pa.

If There Are No Gas Raids Then Everybody Is Sale

I am glad that C. A. S. isn't fooled by the propaganda that akyseropers are safe from gas and bomb attacks by simplanes. A mock

raid was tried on London to test the effectiveness of the defenses. Eighty plattes attacked and every one bombed its objective and got safely away again. The only safeguard against such raids is total and universal disarmament and cooperation between nations. The



only way to get these things is to work constantly for them. Stop profitering in

war munitions and the threat of war will become decidedly less aminous.—C. S., Wyncote, Pa

Here's How the Figures Got Printed on the Eyeglasses

To J M. H. in a recent issue concerning the figures that he saw in the evertasses As you know, glass is a fluid and light is a form of energy. Light waves reflected from the embroidery, speeding toward the lenses, have a definite amount of kinetic energy. When the waves of light strike the glass, they leave an impression of the object in the glass. It is questionable, however, if electric light will do this. I have heard of lightning flashes that left an image on whodows and glasses.—F P S., Albion, Mich.

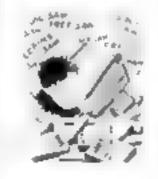
Would You Like To See Plans for a Garden Tractor?

I AM sure a lot of your readers, as well as toyarli, would like you to publish plans for building a garden tractor. I believe there are a lot of old motorcycle engines that would be suitable that could be purchased theap. Ask "Our Readers Say" and see if I am right or wrong And remember its gardening time now—V. B., Quincy, Kan.

He Has Trouble Telling One Saw from Another

I am especially interested in the possibilities your magazine offers for what, I am sure, would be a fascinating hubby I refer to novelty woodworking, small furniture making, etc. But to reading your articles I become confused by mention of fret-sawa, coping saws, scroll sawa, ig-saws, and others. I would appreciate it if you could explain to me the difference between these and the purposes for which each is used. No hardware dealer of my acquaintance seems to be able to give me this information. Some tell me they are all for the same purpose. I must admit that an examination of the tools seems to bear out this statement. I tried using a small coping saw on some one inch soft pine, but broke

the blades. Was this because I didn't know how to handle the saw properly or was it because I was using too small a blade for stuff that thick? Also wouldn't a small compan saw or keybole saw take care of a lot of curved sawing? I should like to arquire a few tools of



the kind but do not know what I want or need. If you could give me a few pointers on this it would be greatly appreciated,— C. L. L., Wester, Okla.

This Ham Defends All His Short Wave Friends

Hann is a shot at W. G. W., Martins Ferry, Ohur Are on a rank of a little work OM on the code? We have can acreas we come another to our cane I am new myself but the more the memer. If you and the rest of the B C L s think the QRM is had may your guardian aner, watch over you it a ham moves into your neighborhood and you get he key rioks. And don't sam us OM if some commercial broke up a good program We hams sel barned for a lot we don't cause just because the B C L s don't know what other causes there are Don't blatne a ham until you can read his call. I often hear from people who biame a power leak on my amster. His Come on now forcet the sun lamp and get into CW ham work Now Editor I have read your magazine for six years or more and I am for it The articles by Frederic Damrau, M.D., are fine The Model Garage by Martin Bunn, the teles son group and model railways are fine too I enjoy the whole magazine but you cut the hams short in the Queer Trade Lingues. As a ham would say your mag in T 9.7 QSA 5 R 9 each im all sides. Here a kep going as QRT the knockers. Put John Care on a single signal rec. OM and five meters is a good band for the experimenter. We can all use dope on it.—J F. H., Troy, N. Y.

Claim of Seventy-Mile Speed Gets a Jolt from a Racer

I wish to protest against the fallacy contained in an article in a recent tissue of Portura Science Monthly, entitled "Sea Gull Boat Skims Water at Seventy Miles an Hour" No matter what the design of the

boat it is impossible to make seventy miles an boar with the present outpoard mover for power. I speak with the experience of five years of outboard racing, during which time I have held several records. The tastest time ever mide with an outboard is \$8.91 miles an hour



This was made with a fifty-five home power special racing Job, turning at 6,200 revolutions per minute. The boat weighed 190 pounds and there were less than fifty square inches of bottom surface on the water actual speed. This record-breaking motor was the only one out of thousands turned out by the manufacturer that was able to turn up as fast as 6,200 r.p.m. The average fifty-five horse power motor turns up to no more than 3,700 c.p.m. I am sure any racing driver will admit the accuracy of these facts.—W B G., Matyville, Calif.

Our Mr. Ryder Taught Him, So of Course He Winza Prize

A YEAR ago I was having trouble getting my pictures in correct focus with the camera I am using I storted reading the articles by your Mr Ryder, Jr., each month, correcting my mistakes and trying his methods. Now, Postulas Science Munritar gives me a prize for doing what Mr Ryder taught me to do!

—J. L. D., Lexington, Ky.

Here's the Mystery of a Pump With a Most Contrary Bump

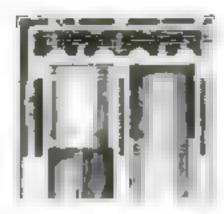
I stroven like to suggest to G. F. M., Marinem Harbor, N. Y., that if he has a class bottom in his aquarium and a space under it large enough, he can either buy or make an air motor that sits on top of a light bulh and turns slowly around when the light is on They are usually made of two or more colors of cellulost. It would make a very pretty effect but I don't know what it would lo so the more fish the gold fish. Now I have something to se I for some wise head to figure out for me. For

the last vear my pump has been act no up It is just an uru-harv trois pump with a handle on it but it I so out after water without any waler to prime it it needs priming If I take some water with melit doesn't need it It has talked only once to a year. That time

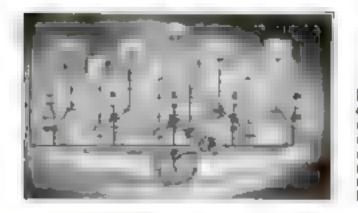


of was dark. Do og suppose an old from pump can see? W. M. R., Jonesville, Mich.

Pontiac's Straight 8 has the longest engine built with 3½ bore



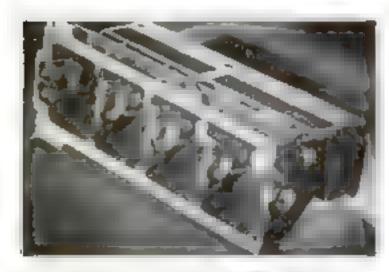
Being longer, Pontiac's cylinder block is case with larger water space around each cylinder barrel. No danger of filling up in casting. Each cylinder is completely and always surrounded by water. This uniform cooling eliminates loss of compression and consequent loss of power, due to uneven wear from unequal expansion.



horsepower (77) is as long as the power plant of the Pontiac Straight Eight. By lengthening the motor, Pontiac engineers have made it possible not only to cool the Pontiac more efficiently and reliably, but they were able to utilize over-size parts. This means less wear on each moving part, more strength and rigidity and resistance to the wearing effect of high speeds over long periods. Because of this, the Pontiac Economy Straight Eight is so highly efficient that it actually costs no more to operate than many smaller cars. Pontiac prices start at \$585, f. o. b. Pontiac, Michigan, special equipment extra. Easy G. M. A. C. terms. A General Motors Value.

Pontise is the most thoroughly and efficiently lubricated engine in the industry. Oil is forced under pressure to all main, connecting rod and camibalt bearings and timing thain, and through rifle-drilled passages in the connecting rods to piston pin bushings. Oil, thrown an absent from the crankpins, drenches cylinder walls, pistons and distributor drive gests. The oil control piston ring is forsted beneath the piston pin—3 compression rings above.

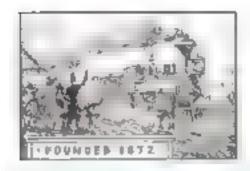




By extending the crankcase 2.4 inches below the center line of the crankshaft, the engine structure is immeasurably attengthened, while the oil pan flange also becomes the same height along all four edges. This permits an oil-tight seal at front and rear bearings. The cylinder block and crankcase are cast in one piece; five sturdy cross-wise webs on the inside attengthen the crankcase and support the five main bearings. Two heavy outside ribs running lengthwise on each side of the crankcase eliminate all possibility of crankcase distornoo.



A water distributing tube running the full length of the water jacket between cylinder burrels and valve ports has holes located opposite each exhaust valve port. Cool water from the pump is circulated through this tube and delivered directly against each exhaust port. From these points it circulates around the intake valve ports, cylinders and combustion chambers and then forward through the thermostatically controlled valve into the radiator. This water distributing tube delivers cool water simultaneously to eleven points along the entire length of the engine. A variation of temperature of not more than three degrees between frost and rear end of engine is thus assured. The use of separate exhaust valve ports permits circulation of water entirely around each valve seat.



POPULAR SCIENCE

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RAYMOND J. BROWN, Editor





HEN the worst earthquake in recent American history rocked southern California, leaving its dead its injured, and its \$50,000,000 trail of wreckage, it gave to science the first accurate record of how the ground moves near the center of a violent tremor

Only a few weeks before, new listening posts in the greatest war on earthquakes had been established in the region. Scientific traps, special seismographs, or tremor-recorders, designed to withstand heavy shocks, had been set up by the U.S. Coast and Geodetic Survey in various parts of southern Cabifornia. As this is written experts are studying the records examining the effects of the more than thirty distinct shocks that sent buildings crashing to the ground in twenty towns and cities.

In these records, they hope to find facts that will bein them pull the teeth of earthquakes by designing buildings proof against their shocks. The California disaster, bringing the men-

are of earthquakes once more into the spotlight, is spurring on the efforts of the American scientists who, in observatories that form a battle-line from coast to coast, are seeking to plumb the secrets of their mysterious for. For earthquakes are not only one of earth's most terrilying

For earthquakes are not only one of earth's most terrilying dangers. They are also one of its greatest mysteries. We really know little about these tremors that come and go with dreadful suddenness and seeming caprice. What sets them off? How can their approach be determined? What can be done to reduce their menace? Such are the questions that moving beams of light, swinging pendulums, ejectric sparks that shoot builts like through strips of paper, and floors that have St. Vitus dance have been seeking to answer in various laboratory listening posts.

At the Massachusetts Institute of Technology, Cambridge, at Stanford University, Palo Alto, Calif., at the California Institute of Technology, Pasadena, special equipment has been installed for earthquake researches. Toy buildings, tiny sky-

scrapers, rocked by the quakes of the laboratory, reveal the requirements of shock-proof structures.

By Andrew R. Boone



4 . 4

ican oceanographets reported a sounding of 44,000 feet, or eight and three-tenths miles, north of Porto Rico, in the Caribbean Sea

An average of 9,000 earthquakes a year are registered by semmographs scattered throughout the globe. Of this annual average, 5,000 are strong enough to be felt, 107 damage buikkings. A world-shaker of the first rank, such as struck southern California, occurs, on the average, every eighteen days. Fortunately, most of these major quakes take place under the sea or in relatively uninhabited regions, of the globe

However this is one of the reasons we know so in le about them. To obtain accurate observations, records must be made near the center of disturbance. A hundred miles away, the vibrations are not the same as at the point of greatest violence. As the earthquake waves race through the rock, they pass from one type to another In changing from, say, granife to limestone, the shift in pace is so sudden that the waves are sometimes reflected back to their point of origin.

Many of the thirty-five tremors which shook cities in southern California were

formed by reflected waves running through the rock layers. Such echoes often produce more damage than the original shifting of the earth's crust

Often in the past, the delicate seismographs which picked up farnway tremors satisfactorily were juried out of commission by a heavy quake, just when their record would have been most valuable. So, up to the time of California's quake, no records were available for study which showed exactly how the earth rocked at the center of violence during a major disturbance

Prehiminary examination of the data collected during the shocks on the west coast reveal that at imes the tremer waves seem to run forward in circles giving the buildings a swirling motion. At other I mes, they have a snap-the-whip effect upon the structures and at

others they shake them back and forth as though they were altached to a piston,

To catch records of this kind, the seismographs of the Coast and Geodetic Survey were mademanytimes stronger than the ordinary instrument. They were designed to record a number of shocks, great tremors lasting four seconds, without resetting. Ten of them, on duty along the Pacihe coast, caught movements of the earth in three directions, east and west, north and south, and up and down. In some quakes of the past, the vertical vibrations have been so severe that boulders were observed jumping up and down like peas on the head of a drum.



With this model shaking table Prof. R. Marrel of the Cautorn a Instituce of Tachnology, shows how cruesbracings can be used to insure the agiety of a building during a quake

Ben STATE OF A LONG MADE STONE MA

This map shows the principal lines of weakhers in the parth a crust in North America. Hose that some of these pass through or near some of our greatest castern cating

Such movements are particularly dangerous in regions built up of sand or alluvial deposits. The 1920 quake in Kansu, China, snuffed out nearly 200,000 lives when hills formed of dust carried by the wind from the Mongolian deserts plunged into the valleys and buried whole villages. Survivors told of lost rivers, buried cities, and "mountains that walked in the night"

Grante such as for as the four dation of New York City and other American centers of population, is relatively safe but not entirely animune to quakes. Geologists point to the Harlem River, connecting the Hudson and the East River and making Manhattan an island, as

evidence of disturbances in the past. This river, they say, runs through a gnoss and limestone garge formed by faulting or slipping of rock strata many years ago. The Nile and the Musissippi are said to follow similar lines of faulting.

Only a few days after the Coast and Geodetic Survey had laid its trap line of strong-motion seismographs along the California coast, it cought its first record of a beavy quake Investigation revealed that the center of disturbance was near Tonopah, Nev., a thousand miles away The shock was computed by seismologists as even more severe than the quake that occurred at San Francisco, almost thirty years ago. Yet, because it took place far from centers of population, it caused little damage and received slight public attention.

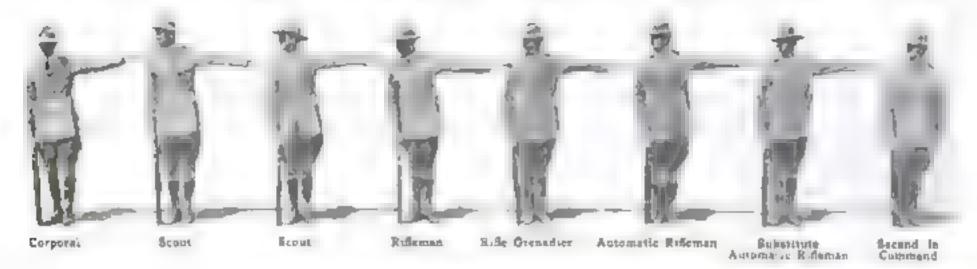
Then came the southern California earthquake which mixed cities, injured thousands and rocked an area inhabited by millions of people. Earth-tremors were again in the headlines and the work of research scientists who are seeking quake-proof structures (Continued on page 104).



When the earth trembled and shook during the series of shocks in the California quake, this auto attacking fit the attest was wretked by falling stones and its occupants were hilled

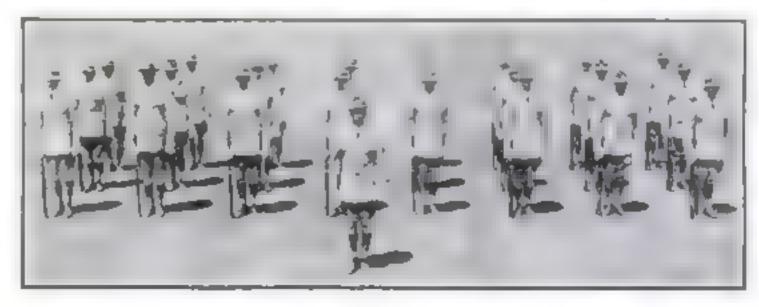
New Army Drill

SWIFTLY TURNS ROOKIE INTO SOLDIER



Above how new equal to formed and as a ghi p section of a antisymon in the brow-tank for metion that to and of the fee upon of the new term.

Arthur Grahame



MID-MORNING sun beat hotly down on a shadeless drill ground lesse shoes crunched on a crushed-stone road-bed. There was a faint smell of sun-warmed oil from carefully-tended rifles.

Fifteen years of civilian life slipped swittly away. It was the

same old army-and yet how different!

To me, who used to stand in the ranks, it was strangely different and a little embarrassing to be standing with a captain in front of a company of Regular Army infantrymen who were to demonstrate for the benefit of the readers of Popular Science Montally the workings of the new Infantry Drill Regulations now being tested by various units of the Regular Army and of the Na ional Guard.

Quite as strange seemed the doughboys' well-tailured rollcodar uniform coats decorated with gleaming brass buttons and with insignia badges enameled in bright colors. Military science leans heavily on psychology, and it's good psychology to make a man look better, because nine times out of ten making him look better makes him act better

Same old army? Essentially, yes! But it's an army that is full of surprises to the old-timer who has lost touch. My biggest surprise came when the captain told a corporal to form his squad.

If you shouldered a rife in the World War, or have served in the National Guard, or have attended military school, you'll remember the squad formation. Eight men to a squad. Formed in two ranks. Four-inch intervals between men. Forty-meh ditance between ranks. The corporal No. I man in the front rank.

"Fall in " The command was snapped out with the old-fasts

toned bark, but it was obeyed in a new way

Foring their corporal, the seven privates formed a single rank. As he took his place, each man except the one on the left of the une extended his left arm at shoulder height, and each man, except the one on the right of the line, turned his head to his right and placed himself so that his shoulder touched the extended fingers of the man on his right. Intervals obt med in this way, they dropped their hands smartly to their more, and snapped their eyes to the front.

I has formed, in a single rank with intervals of about twentyeight anches between the men, the rifle squad is the basic unit
in the new-style close-order infantry drill, Just as it is the
basic unit of the infantry regiment's fighting strength. Organised and trained primarily as a combat team, normally the
squad is composed of eight men who, from the right, form in
the following order. The cosporal, who is the squad leader
two scouts, armed with rifles; a rifleman, a rifle grenadier, an
automatic rifleman; a substitute automatic rifleman, and a
rifleman who is second in command of the squad.

The corporal put his squad through the manual of arms. There were a few changes from the old way, all made in the

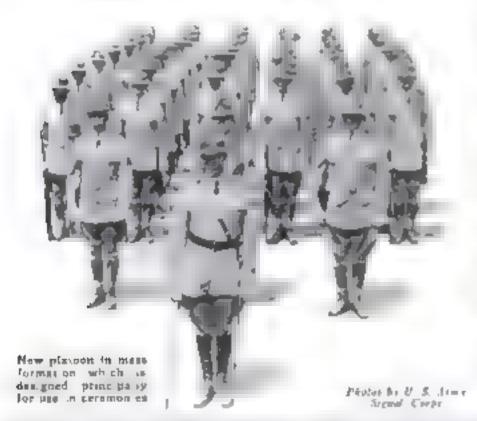


A company in most formation. This is one of the most impressive



Infantry of the American Regular Army passing in review. Here the old formation is being used but the men are wearing the new uniform

Infantry Regulations Made Easy
So Men Gan Be Trained Quickly
for Movement and Actual Combat



interest of simplification and comfort and the elimination of attituding and

To me, the most surprising thing about the new-style infantry squad was that, in line, it nearly always marches to a flank, almost never to the front. In fact, the new Regulations authorize the forward movement of the squad in line only for short distances, and then only with trailed arms.

When the leader of an old-style squad desired to turn and march it from a halt, he gave the command, "Squad right, March!" The result was a movement complicated enough to bring many a rookie to grief, but which, when executed perfectly was impressive in its precision.

All that, I found, is changed. The corporal commanded, "Right face, Forward, march!" Each man executed a simple right face, and then all marched forward, in make file

A moment later, to change the direction of his squad column, the corporal commanded, "Column left. Muschi" The leading man faced to the left in marching, and the other men of the squad executed the same movement successively when they reached the same spot.

And that, in addition to a few easily-learned facings and solesteps, was about all there was to the new-style squad drill

The chief purpose of the new-style close-order drill, according to the new Infactry Drill Regulations, is to enable a commander to move his command from one place to another in an orderly manner, and to provide sample formations from which dispositions for fighting may readily be assumed

Naturally, a large body of troops, such as a war-strength infantry regiment of more than three thousand men, can't march from one place to another in single file. If it did, most battles would be over before the men at the end of the column got any-

where near the firing line

So for deil and marching, and to a lesser extent for fighting, the new-style squads are organized into rifle sections of three squads commanded by a sergeant, with a corporal as second in command.

At the captain's order, a sergeant stepped out and commanded his section to fail in. The leading squad formed in line, as in squad drat. The second and third squads formed in back of it, with forty-inch distance between the ranks.

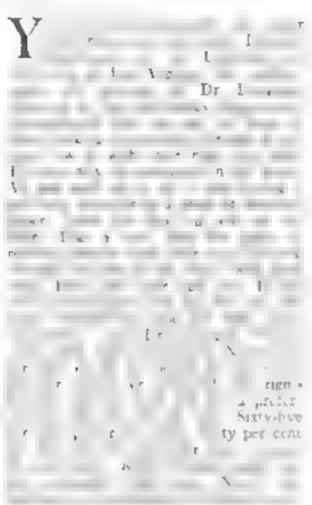
'Right face!" commanded the sergeant That placed the section in a column of threes, with convenient marching distance between the ranks, but with too-wide intervals between the men. "Close march" commanded the sergeant. The center squad stood fast while the outside squads side-stepped to a four-inch interval. (Continued on page 100)



of the new formations, giving the company a front of eighteen sum and a depth of eight ranks

Are You Right Eyed?







USE PORTABLE CAMERA TO TAKE CLOSE-UPS

A NEW motion picture camera moves with the photographer. It is light enough to carry and the cameraman follows the subjects as they move about and takes their pictures. The camera is supported by a belt similar to that worn by a flag bearer. The machine's metal handle fits into the staff socket, an arrangement that prevents vibration while the film handle is being turned. Electricity from a trailing cable powers the camera during its use by the wandering photographer.

BOOK FITS IN COVER

CARRYING a book is easy with the purse-like cover shown at right. Set in the cover are a compurse and a pocket large enough for rail-way ticket and time-table. It is also provided with a marker



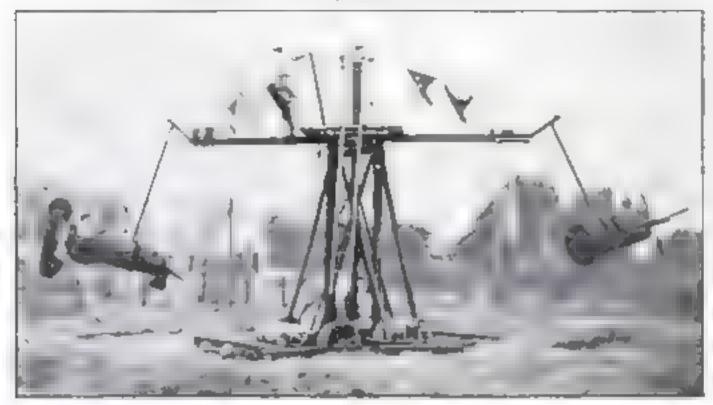
NEW PRACTICE RIFLE FIRES SPOT OF LIGHT

Nerves of accruits in the Bratish Army are saved by a practice rifle that fires a spot of light and makes no noise. The roar of exploding powder and the crash of range rifles upset the young soldiers and subject them to severe nervous strain. To avoid this and yet train the recruits to shoot was a problem solved by the invention of a ride, exactly like the regular army gun in weight and appearance but which, at the click of the hammer, fires light instead of a butlet. At its discharge, a black spot appears on a luminous target as a record of the accuracy of the aim. It is expected the use of the silent ride will prove popular



This rifle looks like the real thing but it fires only a spot of light at the target

Homemade Flying Instructor Gives Air Thrills

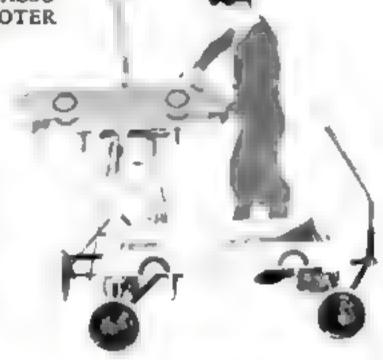


Two eighteen-year-old boys of Turlock, Calif., have built themselves a flying instructor that provides virtually all the thrills of photing a plane. Passengers are strapped in two miniature streraft that fly in circles around the supporting framework, under the power of gasoline motors, as shown at left. The baby planes are tethered to a rotating crosspiece in such a way that they are free to rod and perform other aerial evolutions at the pilot's touch of the controls. An operator riding on top of the crossbeam may apply a brake lever, or cut off the ignition, if the enthusiastic pilots acquire too much speed. Over week-ends the boys tow their device on a trailer base to nearby towns, and tharge for rides.



BOY'S WAGON ALSO PLANE OR SCOOTER

IDEAL for the boy who enjoys taking things apart is a convertible coaster wagon recently placed on the market. A wrench is the only tool needed to remodel it into any one of fifteen different shapes and sues. A few minutes' work changes the toy from a wagon to an airplane, as shown in the photograph, or to a scooter. Models from three to six feet long may be built with the parts.



CARBURETOR MIXTURE TESTED BY NEW GAGE

A NEW exhaust pas analyzer automatically tests the adjustment of a car's corpuretor. When a tube, connected to the device is inserted in the car's exhaust pipe, a pointer awings to "lean," "normal" or rich." Operation of the device depends upon two sensitive wires, one scaled in air, the other exposed to the exhaust gases. The latter will lose more best than the former if the mixture is too rich.

GIGANTIC X-RAY TUBE FOR CANCER PATIENTS

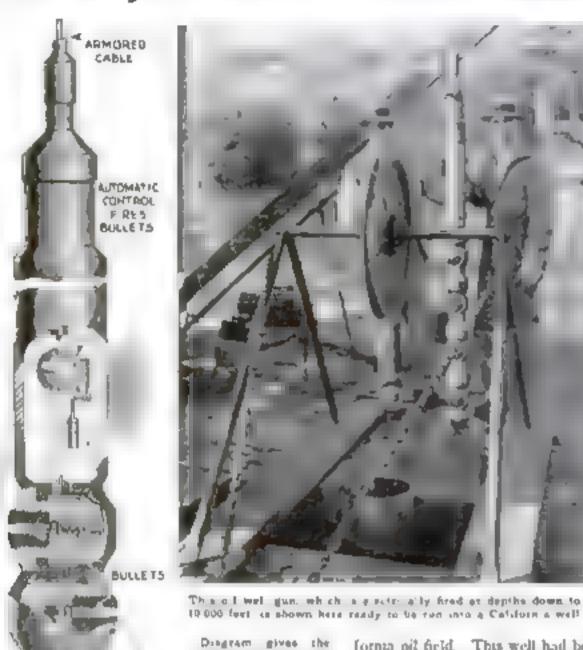
A BIANT X-ray tube, operating at \$00,-000 votts, has just been completed by General Electric engineers for use in treating cancer patients at a Chicago hospital. So powerful is the fourteen-foot tube that it is water-cooled, and its radiation is estimated equivalent to that obtainable from \$75,000,000 worth of radium, X-rays are produced by the impact of a beam of electrons upon a massive tungsten target four inches in diameter



Insert shows an ordinary X-ray target, lef- c in

paved with the four-coch (arget used in new the

Dead Oil Wells made to flow by New Electric Gun



10 000 fort or shown here ready to be run into a Californ a well-

main features of the

electric gan and shows

how arrest free it

The electric current to fire the gun in supp sed by d tracer gengegter ogt which is placed an durrich Sout

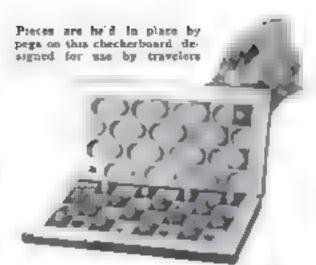
ARTRIDGES

THE ROLL

EAD oil wells are brough to life by means of a new electric gun that is discharged thousands of feet beneath the earth's surface. With at hores are shot through steel pipe and cement so that oil from a zone higher up can flow into the well. The gun s .45 caliber steel bullet must pierce pipe that sometimes as nearly a half inch thick, and there may be more than one such pape The cement may be anything from an inch to several inches thick Terraic explasive force is necessary and the bullet must be of hard alloy steel. It was tested recently in one of the wells in a Cali-

forma oil field. This well had been comped dry in May, 1929, but a higher sand was thought to be commercially valuable. This sand, box ever, had been cut off permanently with two strings of pipe. The gun had to be fired at a depth of over 7 600 feet in a hule six inches in diameter. After four shots had been fired, oil started coming into the well. After eighty-seven shots, the well was producing approximate vibity barrels a day. The gun consists of a control mechanism helow which is a series of fixing units each containing a bullet and powder cartridge. The bullets are pointed en any desired directions and can make the holes in the casing and cement at any vertical interval. They are fired successively or in groups

the time of firing being controlled at the surface. The cartridges can be detonated only by a thermal element heated by an electric current. The mm is run into the well on an armored cable which contains a conductor wire. When the electric circuit is closed, the current passes down the cable, through the control mechanism to the thermal unit and fires the shot Direct current, supplied by a motor-generator set on the derrick floor, operates the gun which, it is said, can be fired at the bottom of a 10,000-foot well. Thus it could be used to the deepest wells that so far have been drilled.



PEGS HOLD PIECES ON THIS CHECKERBOARD

Destgnen especially for travelers, a new checkerboard is unusually compact, although the pieces are sufficiently large to be handled with ease. The ring-shaped men fit into receased compartments when the board is closed, and are automatically set up when it is opened for play Each playing square is provided with a peg that holds the piece placed upon it, so hat the board may be held in the lap or moved about without causing the men to slide. Kings are made by placing two parces on one peg

LIGHTS ADD BEAUTY TO MODEL OF SKYSCRAPER

Flow translucent glass panels and colored light can be used to enhance the beauty of a modern building is demonstrated in a ten-foot-high model of a skyscraper Just completed at Nela Park, Cleveland, O., for exhibition at the World's Fatr in Chicago, It represents a fifty-story building, accurately con-structed on a scale of 1/64th of action size, gleaming with ribbons of light and set off by colored floodaghting. Hamma ir g engineers foresee that such decor, we effects will be widery used



A model filty-story skyscroper built to scale. is lighted to abow how lamps can beautify it

Eighty-Foot Fence of Mesh Guards New Golf Course

Any mashie or niblick would have trouble lifting a ball over the twenty time of fencing that protect the driving range of a new golf club at Portland, Ore. The barrier of chain link fabric is eighty feet at its highest point and tapers to thirty feet at each end. It is the highest fence of its kind in the United States. To secure sufficient support for the mesh, a local electric company installed twenty-four poies at intervals along the course. Cable was strung between the poles, and the fabric fastened to it.

The facest puzzle fad requires that the pieces of colored wood shown below, be put togother to form a cube



BLOCK PUZZLE NEW FAD

Block puzzles, distant relations of the jig-saw puzzle, are now on the market. The oddly-shaped pieces, when assembled, form a perfect cube. In the latest variant of this popular fad, illustrated above, the assembled cube is supplied in a cellophane wrapping that holds it together. Its pieces are painted different colors. By noting the pattern before taking the block apart, the novice may obtain a belp-fulclue to the solution.



Eighty feet high in the center portion and sloping to thirty feet at the ands this much leace, supported by point and a cable, keeps golf bails within bounds



BULLET-PROOF STAND FOR SPEAKERS

A BULLET-PROOF speaker a desk has been devised by engineers of a broadcasting system, to protect public men from the attacks of assassins when making addresses to large gatherings. Metal armor shields the body of the speaker from below his waist to a point several inches above his shoulders, when he stands upon a platform Four microphone outlets are spaced across a panel behind the desk, while spring clips and a lamp are provided.

WATER TOWER PART OF TOWN'S CITY HALL

Restnexes of the little desert town of 29 Patms, Calif., claim that their city half is not only the smallest in America out the most versaine—for it serves as a water tower as well. This odd structure provides a meeting place where the dozen inhabitants of the community may transact their legal and municipal business. The photograph at the left shows half the population of the strange little town reading the daily paper, which is tacked to to the wall of the building



Flying Over World's Highest Peak



The interior arrangement of the two British exploring planes a clearly shown in drawing

to press, the world waited for news to be flushed that they had succeeded.

More than a stunt is the perilous attempt. Geographers await with keen interest the first photographs of the summit, which no man has ever seen, and of its surroundings, where dramas of heroism and tragedy have been enacted. Another and even more practical object is to show that even the world's highest peak is no barrier to traffic by air. An Everest flight may blaze the trail for future airlines across central Asia.

generations of climbers. As this issue went

planned to circle above it, in lonely

triumph, while mapping and moving cameras recorded their conquest of a mountain that has defied countless.

Flying over Everest resembles on attempt at an airplane altitude record, with the added difficulty of carrying and operating a heavy load of cameras and equipment, as the illustrations on this page show Since the air at the summit is too rarefied to support human life, the flyers breathe through oxygen masks. Their tives depend upon keeping the valves of he oxygen apparatus from freezing. To combat the intense cold, electricity warms. these valves as well as the flyers' clothing and their cameras. Superchargers, attached to the airplane engines, enable them to function in than air. The planes are designed to reach an altitude of 34 -000 feet, enough to clear the summit by 3.000 feet. From this aerial point of vantage the observers will be able to do as much in three hours, the total time estimated for the flight, as explorers on foot could do in years even if they were successful in scaling this towering peak.



Mr Everest Syers will wear garments like these and breaths through suygen much



AIR GUNNERS PEPPER GROUND TARGET



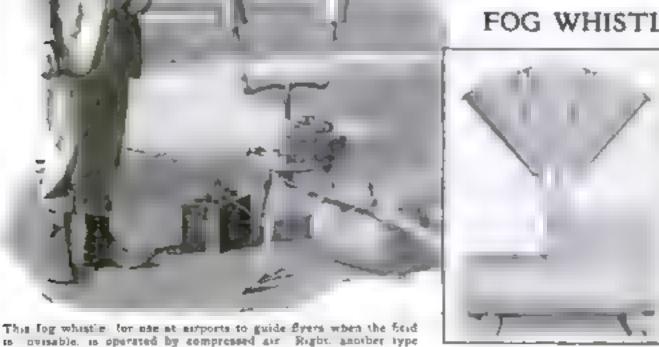
RAKENG ground targets with machine-gun fire, members of the Ninety-First Observation Squadron recently ran up high scores at a new practice range near San Francisco, Calif. The paper targets, ten feet wide and six feet high, were propped up on adjustable mounts at an angle of sixty degrees. Daving on them in formation, the pilots riddled the black buliseyes with flying lead and tracer bullets. After each attack, a ground crew covered the bullet boles by pasting bits of paper over them so the targets could be used again without covering the framework with a completely new paper The maneuvers were part of ground straking practice, in which the planes dive and skim low over the ground with their machine guns blosing. In wartime, the maneuver is intended for use in an attack on trenches or supply trains or on infantry lines when on the march

HUGE LION CUT IN CHALK WARNS FLYERS FROM ZOO

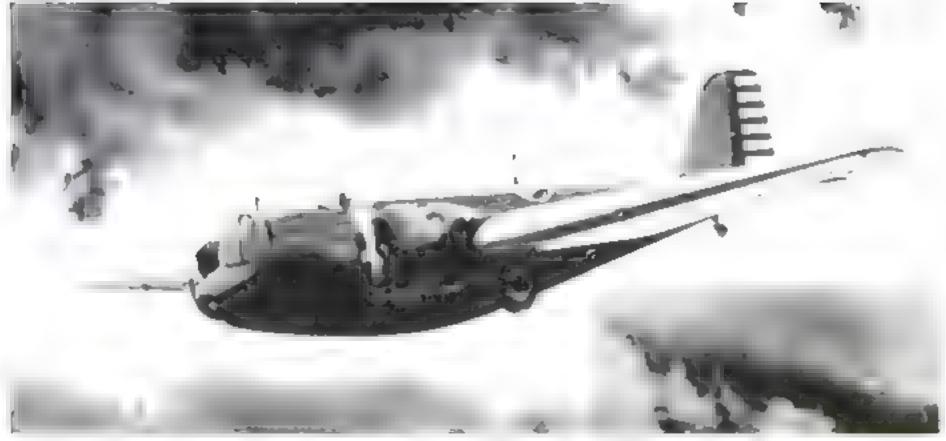
LATEST among odd ties in ground signs to meet the eyes of airmen is a huge white from of glistening chalk at Whipsnade, England, This figure was cut in the ground at the request of the Whipsnade acc, where animals had been terrified by the rearing of motors of low-flying airpeanes, and it effectively warms approaching pilots to keep their distance. The size of the sign may be judged by comparison with the trees in the foreground of the striking aerial photograph reproduced at the right Situated about thirty miles outside of London, the white lion serves as a landmark to airplanes approaching the metropolis from the northwest, plinough its presence might pass unletected from nearby motor bushway.



FOG WHISTLE FOR AIRPORT



Fog whistles for airports may soon enable a pilot to land safely when weather conditions make it Impossible to see the field, General Electric engineers announce the development of a new sonic marker beacon that emits a series of short, high-pitched whistle biasts from a cluster of two or three megaphones. One of these beacons would be installed at each end of the field, and the pair arranged so they would sound alternately When an approaching pilot hears a continuous blast, he knows he is above the center of the field.

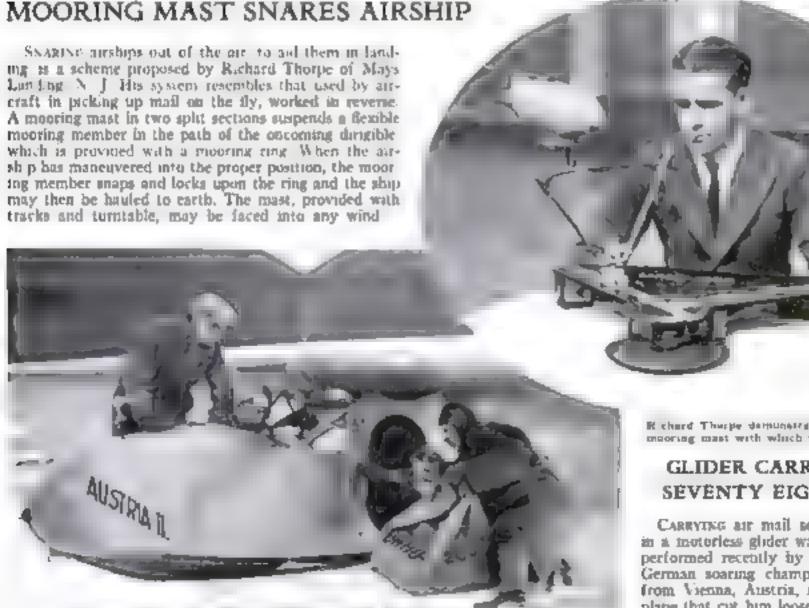


Army Bombing Plane Outflies Pursuit Ships

A new bombing plane, developed for the American Army, may alter present styles in acrial warfare. Hitherto tiny, one-man pursuit craft have been relied upon to overtake and attack enemy bombers. In practice flights they wheel and carcie about the big bombing machines which are slowed by heavy loads. One of the new Martin bombees, however, turned the tables on its pursuit slops by out-

distancing them during a recent practice flight from Dayton, O., to Washington D. C. Its pilot throttled down the two 550-horsepower motors on the wings, so the pilots of the other craft could keep up with him. While the speed of the new craft is an official secret, it is reported to exceed 200 miles an hour Mintary observers foresee that a firet of the new bombers could strike a telling blow in war-

fare, dashing away too fast for enemy pursuit craft to overtake them. The atlmetal craft carries 2,000 pounds of hombs. A machine gunner at the forward end is protected from the air blast by a revolving, transparent turret. Landing wheels are drawn up in flight. The U.S. War Department has just placed an order for thirty-eight of the new machines. The photograph above shows one in flight.



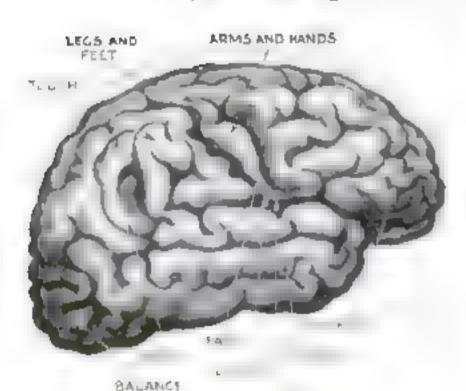
Into this motorless glider are being loaded 100 pounds of mail preparatory to carrying it without power from one city to another seventy-cight miles away

Richard Thurpe demunerate of his mode of a mooring must with which to find big artib pa

GLIDER CARRIES MAIL SEVENTY EIGHT MILES

CARRYING air mail seventy-eight mines in a motoriess glider was the record feat performed recently by Robert Kronfeid. German soaring champion, He took off from Vienna, Austria, in tow of an airplane that cut him loose at an altitude of 12,000 feet. Soaring to Semmering, Austria, he unloaded his 200 pounds of manone hour and forty minutes after the start.

OPERATIONS ON Human Brain



This drawing of a human brain shows the open a sed func tions control ad by the ver our sect one. It is necesse these great a # kndwn that surgeons are able to three a classification and nustin the head. At right diagram showing how you can draw two magazing inch on your head to help you find the parts of your brain that govare control activities

JAWS

mark a big advance in Modern Surgery

the right because at contains the centers for speech and writing and governs the right side of the body, was perfectly bealthy,

Four times before, Dr. Gardner knew distanguished surgeons had removed the right hemisphere of a patient's brain and every time the results had been fatal. Yet, it was the woman's only chance. With deft hands he shipped loops of catgut around the arteries and veins and

pulled them taut. This stopped. hemorrhage. Then he scooped the entire right half of the brain, containing the buge tumor, out of the skull!

The cavity was fided with warm salt solution, the plate of bone replaced and anchored with silk, the flap of scalp sewed back in place, and the operation was over,

A few hours later, the woman recog-nized and tasked with her friends, She improved rapidly, reading and writing during her convalescence. Her headaches and epileptic fits were gone. Although her left arm and leg were stiff, due to the loss of the right bemusphere of the brain, she was able to walk and three and a half months after the operation, she was helping care for her children.

One of the most amazing things about the human brain is its ability to recover from seemingly-fatal injuries

I recall one case during the World War A soldier was brought back from the lines the front part of his brain riddled with shrapnel. We removed one piece, lodged deep between the two frontal lobes, which was two inches in diameter. The rest we did not dare touch because the fragments were too widely scattered. Nevertheless the pottent made an excellent recovery He was not paralyzed in the east and his senses were unimpaired. The only troubles

F YOU were in an operating from watching surgeons working on the brain, you would see things that would make you gasp. For example, at the Cleveland O Chnic August 31, 1931 Dr W James Gardner removed the entire right half of the brain. And the patient recovered

A woman, thirty-one, mother of two small children, had suffered from epileptic fits for ten years. She was becoming blind and had terrific headaches. The pressure of a growing tumor maide her skull

was kaling her

From the right side of her shaved bead Dr. Gardner removed a section of skullfour and a half inches in diameter. Then be cut through the dura, the tough protecting membrane covering the gray matter. Under it, he saw a couliflower-like growth covering the surface of the brain. It had eaten its way like a cancer throughout the entire right hemisphere. The left haif of the brain, far more important than



In preparation for a brain operation, the head of the patient is first abaved. In left fore-ground, is the anesthetist who is watching the instruments that recard the bised pressure



ByFREDERIC DAMRAU, M. D.

The Remarkable Pictures Illustrating This Article Were Taken by Our Photographer During an Actual Brain Operation

that remained with him were Jowness of speech and a tendency to forget apparatues a

On the Fourth of July, three years ago, an eighteen year old buy in Fargo, N. D., placed

two lighted freetrackers in the barrel of a tire pump. They exploded with such force that they blew the handle off the pump and drove the piston shaft, a steel rod five-sixteenths of an inch in diameter and eighteen inches long through the boy's skall and brain. It entered near the right eye and projected from the back of the sku i

Dr. Joel C. Swanson treated the boy for shock, gave him antitoxin against lockjaw and sterilized the protruding ends of he shaft with fod no. Then he pulled the shaft out. The boy recovered and successially completed another year of high school. Apparently, his mind did not suf-

for from the accident

On record in one European hospital is the automishing case of a shoemaker who. during a temporary fit of insanity, tried to conjunt suicide by driving nails into his head. When he was brought to the hospital five two-such nails penetrated through the bone of the skull into the brain. Yet, after a surgeon removed the nails, the man recovered and he was later discharged completely cured.

Most incredible of all, is the story of the New England laborer who lived for twenty years after an iron bar, an inchthick, had been driven by an explosion through his skull and brain. The bar entered just below the left cheekbone, de-

At this point in the operation. the incision in the scalp has been made and of pa are bring put in place to how the edges of the save ad acatp away from 156 exposed sixed. As right the war geon is ho ding his hors a trady to at through the scalp of the pal ant who is becomestous

> stroying the left eye, and a large part of the brain. and coming out at he top of the skull. Not only did the victim of this accident make a miraculous recovery, but he continued to perform his duties as a farm-band and touchman to the en the samplaction of his employers

Sach arcidents to the brain have played a part in entertaine the saltreon's knowledge of this vital organ. Step by step med ica, men have built JD a mass of informa ion shogt 1 by observation of

the sick, study of the brain after death is hopeless cases, and by stantulating the brams of dogs and monkeys with an efectric current

During the Franco-Prussian Was, two Getman physicians, Gustav Fritsch and

Eduard Hitzig, stimulated the brains of wounded soldiers and for the first time produced definite movements in unconscious humans by means of an electric current. Applying the electrodes to one spot, they made the legs move, to an-



Surgeon curring a piece of colluloid to the desired shops to replace home from shall of patient shown on page 25

other, the face; and to another, the fingers. Thanks to experiments on dogs and chimpanages, the surgeon now knows exactly which part of the brain controls each function of the body. According to the symptoms, he knows just what part of the brain is diseased and where to operate. In the field of brain surgery, there

can be no guessing.

There is a simple rule by which you can map out, on the outside of your skul, the location of the motor area that controls all the movements on the opposite side of your body. Draw an imaginary one from the root of your nose over the top of your skull to the bump on the back of your head. From a point half an inch behind the middle of this line, draw another line, three and three-quarters inches long, extending downward and forward at an angle of seventy degrees. In front of this line is the control-room governing bodily movements, the motor area of the brain in control of all your movements.

BEHIND the line is the portion of the brain that governs all the sensations to which the body is exposed. The only nerves connected directly with the bemispheres of the human brain are those control ing the sense of smell. Originally, our

brains were smelling organs

Just behind your furehead, are the frontal lobes with which you do your thinking. Savages and idiots have low, receding foreheads because this part of their brains has not developed. Strange to say, when one of these frontal lobes is destroyed by an abscess or a tumor, some other part of the brain tries to take over its functions and do the thinking

Many genuses have waled their brains o medical science for careful study under he microscope. Examination of the brain of Anatole France, the famous French writer revealed that the convolutions and

gray matter cells were both oi exceptional development. When Vikinar Lenin, founder of the Russian Soviet Republic, died, his brain was sliced into 31 -000 specimens and studied carefully by many scientists, Turgueneff, the Rusman novelist, had one of the largest brains on record. It weighed more than four pounds. However, the size of the head is not an accurate measure of intelligence, for one of the two brains that exceeded has in weight was that of an imbecile. Large brains have no more units than small ones but the units are larger.

In the back part of the brain is located the center of sight. A tumor or injury here causes blindness. The lobe of the brain near the car governs hearing. Just in front of the lower

port of the motor area is the voice center. On the flat surfaces where the two hemispheres almost come together are the centers of smell and taste. We hear words with one part of the brain; see words with another part, and speak words with a third.

STRANGE things occur when any of these centers are disturbed. In one instance, a professor who used Latin and Greek fluently was struck on the head in an accident. When he recovered, he had forgotten every word of these languages. The cells of the brain in which they were stored had been permanently injured by the blow while the rest of the gray matter remained normal.

In another case, a little artery that supplies blood to a small area in the visual region of a patient's brain became plugged. Overnight she became as illiterate as an Australian Bushman. She could see perfectly but she could not read a word. She had been struck by word-blindness, a rare brain affliction which prevents the recognition of words when seen in type. Similarly, when another center of the brain is injured word-deafness results. Hearing is acute, but spoken words mean nothing. In one small patch of gray matter, hardly larger than a makel, is stored every word we know!

A few weeks ago, medical authorities were amazed by a report coming from Los Angeles, Calif. A twenty year-old Mexican girl, day after day ran a temperature of 110 degrees. One hundred and seven degrees had been considered fatal. The Medical Director of the Los Angeles General Hospital reported that for more than a month the girl lived with a temperature higher than that of any other known sufferer. Specialists who examined the potient concluded that a tubercular

brain had upset its normal operation in regulating the temperature of the body

Because a surgeon can lay out a map on the skull of a patient and know that under each section be the cells controlling a special function of the body, he can know the exact position of any trouble. New methods of diagnosis, such as injecting air into the brain cavity, have also increased the accuracy with which the surgeon can trace the effect back to its cause

REMEMBER one man who was cured of epilepsy by the removal of a brain lumor that we found in this manner before an operation. Since convulsions invariably started in his face, we knew that the trouble was in the motor area, hear the lower third of the previously-described imaginary line, running from the nose to the back of the head. To determine its size and position, we drilled two small holes through the skull near the bump at the back. Hollow needles, pushed through the brain substance into its central cavity, drained off some of the fluid. Finally air was injected into the cavity and X-ray pictures taken. They showed that the cavity inside the brain was entirely out of shape on one side, due to the pressure of an extensive brain tumor. With this knowledge at our command, we were able to remove the growth successfully in a single operation.

In New York, the famous brain specialist, Dr. K. Winheld Ney, with whom I worked during the World War, has recently developed a speciacular new technique for curing epilepsy, which he has demonstrated to be caused by the sagging of the brain after it has become attached in places to the top of the skull. The fits, in such cases, are caused by pulling upon the attached portion of the brain, Dr. Ney's (Continued on page 103).

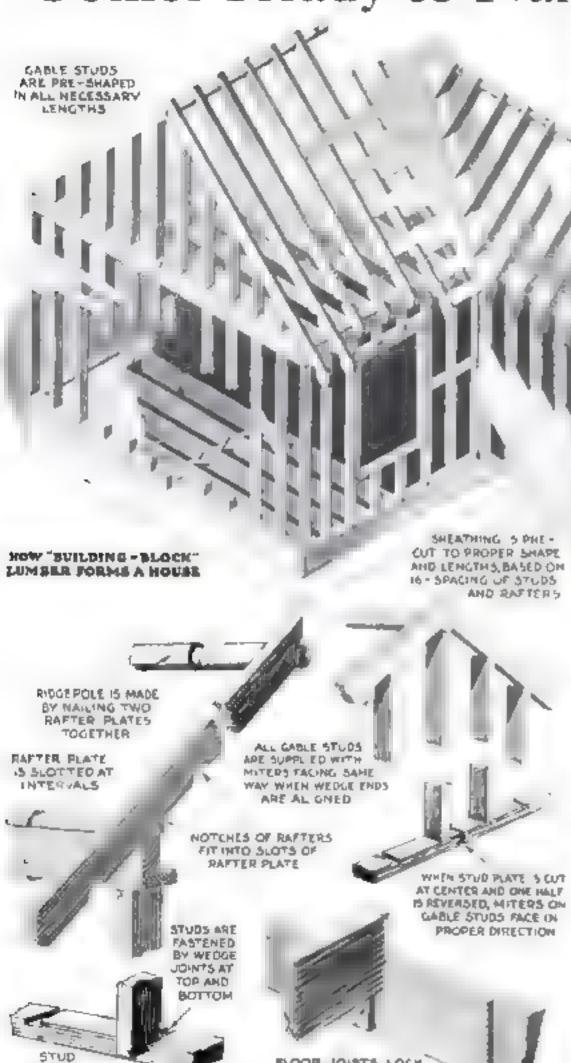
Below is an X-ray picture, taken recently, of the head of a man who was stabled they years ago and a whole head he binds remains. It count be removed



Sensational cures are now effected by strange, new operations upon human glands. Next month, Dr. Damrau will tell the exciting story of this dramatic work

tumor in the beat control center of the

New, Shaped Lumber Comes Ready to Nail



HOME RISES QUICKLY WITH THIS MATERIAL

FLOOR JOISTS LOCK

INTO HEADERS BY A

PATENTED WEDGE JOIKT

l'histrations about the form in which the lumber for bonnes in sold to builder and how it can easily be assembled in estrong a dwelling. More the notches and wedge-shaped joints that speed the job of putting the pieces together readily and with little chance for making a mistake



THE ROOP

Ten Designs in Material Provide Wide Range in Size and Style for Frame Houses

RE-CLT pieces of lumher that ht toge her as simply as the intersocking blocks and strips of a boy's toy construction set are now available for building homes. The new method simpli-

bes the carpenter's work and speeds the construction of a frame dwelling, since more than three-fourths of the lumber used in a house may be delivered to the site ready for assem-

bling without further cutting

Only ten basic designs of members are required. A number of these are blusters ed to the accompanying drawings. There is no aretation to the size or style of house that may be built with the pieces, beyond the fact that i - dimensions must be multiples of sixteen in hes, the fundamental unit of size upon which the designs have been chosen.

Frour justs are attached to beaders, and stude to stud plates, by means of a strong interlocking joint. This is provided by a patented wedge-shaped tip and a socket of corresponding design. Half-round strips, slotted at intervals, support the notched rafters. Sufficient points for pracing the rafters are provided to assure an almost limitless number of

possible roof spans and pitches.

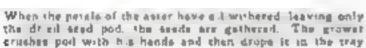
Each style of member is supplied in a gumber of lengths, cut with precision at the factory so that no further corpentry is needed Not many lengths are required, however, for most building jobs, so the lumber dealer need not carry an overly large assortment in stock. Among the other advantages pointed out by the manufacturer of the "building block" lumber are that it is impossible to install any paece in the wrong place, dispensing with the need of numbering and sorting pieces, and that the standardization of pieces simplifies the figuring of the job and eliminates mistakes in ordering the lumber

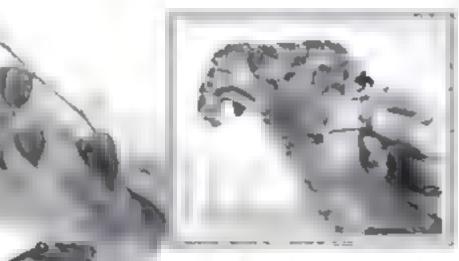
PLATE

GROWING Garden Seeds Now Giant Industry









Freds of the cuscomb are found be neath the flower and drop off when the plant in shakes. In the case of the dah is, as top the aseds are in the weet of the flower At sit, the Japanese Lanters must be tern apart of older to get access to six aparts.







Seeds his fanned less of hubbs and chaff and then they are flushed with which of is being demonst used below by Junoph W. Badman, well known seed grower. Cleaning easile in this way is the first step in their transment of er he no gathered





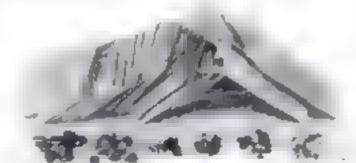
See 2 St. and a new person or come of the second of the se





Thu and carried a new a hear hear







t to a sea of the seasons of the sea

No Job Too Tough for

Emergency Division of Police Tragedies and Freak Accidents



NEW building was going up. Before it stood a big concrete mixer
To chew up stone, gravel, and
sand, its vat-like interior had
strong teeth, powerful flanges, and cogwheels. To keep these fed, was the job
of one man who stood on a running-board
and watched those teeth grind concrete

buddenly the man sloped. Frantically vamily clutching for safety, he toppled into the mixer's jaws. Brussed, half smothered in liquid concrete, he was shocked by violent pain His leg had been caught in the cogs. Those crunching teeth were tearing fiesh and breaking bones. His screams of pain and terror brought men on the run.

Barely in time, they stopped the mater. It had ground up its victim's leg, nearly to the hip, and still held it in a cruel grip. Pain-tortured, he lay, half submerged in the concrete, whose gray was stained red by his blood. Before he bled to death, he must be got out. The gathering crowd milled about, crying, "Get a doctor!" A policeman run to a telephone and put in an emergency ca.!

Two minutes later, a screaming siren announced the coming of a dark green track trimmed with twinkling brass. From it leaped young poucemen, who dashed for the machine that had trapped a man. The sergeant sized up the situation

If we move those wheels, he said "we'll kill him."

Quickly the men in blue brought a stretcher, blankets, oxygen tank, and an acetylene torch. While some of them tended the injured man, others using the acetylene torch, skillfully and swiftly burned away the heavy steel cogwheels. Gently they lifted the victum out and into a waring ambulance. He would lose a

Thomas M.

Johnson

ice, but he would live—thanks to the

ieg, but he would live—thanks to the green truck.

In a few hours the green truck collect again. This time through dark streets to a loft building. There stood a patrolman.

C mon," he urged. "Here he is!"

He turned his dashlught into an open coal-chute. It shone upon a glistening bald head entitely surrounded by coal. A plaintive voice implored

"Get me outa here"

"Is that your burglar?" the Sergeant

Sure," replied the patrolman, "Tried to get in through the coal chute, and got stuck. That's an emergency, so I sent for an Emergency Squad. Right."

From the green truck were produced sledge-hammers, crowbars, saws, chisely, wrenches, and shovels with which they due out the burglar

To meet situations as widely different as these two, the green tracks carry, all told, 103 different pieces of equipmentprotoction in an emergency members of the new po ice unit test the masks by going builty into a heavy cloud of gas Craws of the Emer-

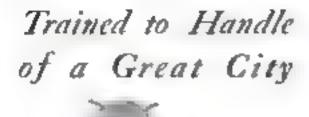
manks will be effective

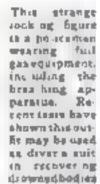
Crews of the Emergency Division of the prince force answer a group in trucks the the one pear at left

and their crews are trained to use them. This Emergency Service Division is the most versatile and adventurous branch of the whole New York Police Department. Its green trocks don't roll unless the rest of the Department is more or less stumped—whether by a basardous rescue, a riot, an explosion, a gas suicide, or one of New York's thyriad freak occurrences, as for instance, horned owls. They were keeping people awake nights in peaceful Flushing, Long Island, part of the Greater City So a green truck went, with portable searchlights and shotguns—and the owls hooted no more.

To meet any crisis, hig or small, the Emergency Service Division has called to its aid science and invention. Inspec-

Minute-Men Cops







After a drowning man is taken from the water this cake at its used by the Erre gency pin co in an affect to the verthe oncohectous victim

taboratories and gas chambers where they experiment constantly is an effort to find new means to save human beings from death by any gas—natural, furnigant, carbon monoxide. For every gas suicide, a green truck rolls, and its trained men have worked thirty-five hours to save a

life some one had thought worthless. Seven policemen once saved a baby by breathing into its mouth meessantly for two hours. Suicides increased in depressed 1932, but not

gras soucides.

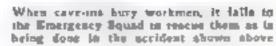
That is a phase of the defensive work of the squads, which makes them an effective "save-a-life league that there is a grim offen-

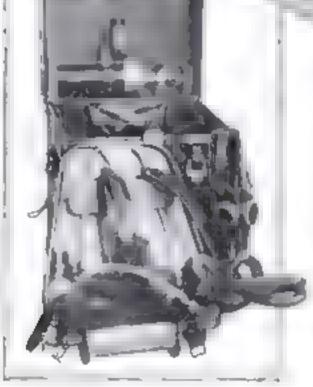
sive side to their operations.

One of the most amazing events in modern crime annals, was the seize of Two-Gun" Crowley a couple of years ago. This notorious criminal and cop-killer was run to earth in an apartment house of upper Broadway. There, with a man and woman to help him, he stood siege, suiping at the police who were firing from the street and nearby housetops. A crowd of thousands guthered. Every police official from Commissioner Mulrooney down, was present. But it seemed impossible to make the capture—until the green trucks turned the trick.

Their crews came running, with light machine-guns that every truck carries. Working up as close as possible, they unloosed a crashing, ripping fire, that kept the desperados cowering on the floor. Then down upon them builled gas gronades that exploded, filling the small rooms with choking tear-gas. Snatched from the green trucks, dropped through holes in the roof chopped by axes from the same trucks, the grenades turned the tide. Blinded, weeping, "Two-Gun" and his mates came out, hands up

Against another gas, the squads have





The full McCan breathing apparatus that is worn by the police in a gan fill of room

tor D. A. Kerr and Deputy Inspector Louis F. Dittmann welcome new ideas and better methods. The present Division of \$12 men, manning twenty trucks so distributed that in three or four minutes one can reach any point in the city, is New Yorka newest police unit. It has saved an estimated \$10,000,000 to the city, and its usefulness increases. In 1931 green trucks rolled 5.928 times, in 1932, between 5,000 and 6.000 times—a thirty per cent increase. Other American cities are adopting the idea, and the British Government has made specific inquiry about its anti-gas measures.

New York does not dread gas air taids in the next war as does London, but the emergency squads are trained to wage chemical warfare. At their headquarters in the Police Academy building, they have



When the Emergency police are capled upon to make a rescue from a high piece this life belt naures the salety of the officer



Emergency trucks respond tostantly when a flot call themes in Armed with tear gas and much be guns. the crews suppress hant a garberings even when the mob greatly outnumbers them as shown in photo

made a counter-offensive to defeat its menace to life and health. This is hydrocyanic, or prussic, acid gas, Colorado uses it to execute murderers. New York warehouses and other establishments began to use it as a fumigant.

Come quick " pleaded a frightened tecephone call, "Everybody here is dy-

·BE. The crew of a green truck found a restaurant in which men, women, and thildeen lay in a stupor with faces and bodies convulsed. A strange oder filled the room Hefore they had got everyone out, policemen were strangling. In vain they sought throughout the restaurant for the source of the gas. Then someone went to the warehouse and stooped to the keybole He staggered back, clutching nose and throat. He had found the source of the gas. The warehouse manager, deciding to fungate, had turned on the gas, locked the door and gone home. The fumes had seeped through to the restaurant and nearly killed everyone there.

Thus the emergency squad had its first experience with hydrocyanic acid gas. Into a chamber filled with it, walked Inspector Dittmann, unmasked, to test human powers of endurance. Presently followed protective devices, a prescribed treatment, then a general order that anyone insisting on using the deadly stuff must notify the emergency squad and get

brom this defensive chemical warfare has come a discovery that may develop into a new means to save lives from frowning. The emergency squad first adopted the McCaa Breathing Apparatus and a suit of gas-proof clothing as special equipment for policemen going into gas-filled rooms or buildings.

Early last summer those visiting one of the city baths, marveled to behold policemen clad in these gnome-like outfits, disporting themselves under water. On August came an opportunity for a real but sad test of the equipment. The twelveyear-old son of a New York policeman, attending a summer camp at Delaware Water Gap, Pa., had good swamming and drawned. The body could not be recovered Patrolmen Kiernan and Wynn, with Inspector Delimann, took one of the gas outlits to the scene. Moored to shore by a rope, Kiernan walked into the river. An hour spent under water, with short rest intervals, and he had found the body. As a result, the Red Cross, Boy Scouts, and other organizations are now experimenting with the same suit, and the Navy is testing it as a new safety device for pilots of amphibian planes.

Already the rubber suits have proved their worth in a hazardous rescue along the marshy shore of Batren Island in Jamaica Bay On a raw autumn evening, squatters there heard a cry for belp. Rowing toward the sound, they saw across the water the head and shoulders of a young man, barely above the mire. Francisca is be ened to them

Help! Help! I'm sinking!"

Hunting feed-birds," they told one another "Caught in a quagture. And we can't get to him, The reeds are too thick?"

One boatman raced for shore and a telephone. Down to the water's edge came

the truck of Squad Fourteen Out tumbled Patrolmen Padrick, Van Thunen, and Janosy, Hurriedly they donned rubber suits and, taking a 100 foot line, waded out into the reeds. Daring the treacherous slough that had nearly entombed the man they wanted to save, the policemen forged their way toward him.

When they at last reached their man, the quagrante had dragged him down until water was lapping his throat. To keep it from running into his mouth, he had to tilt his head back as far as possible. Drowning by inches was about to complete the work of fright and cold. The three policemen barely managed to drag him from his living grave with the long rope from the

truck. When that fortunate you h Edward Foley, 16, reached the hospital, he was blue from head to foot, but he was soon out again, hunting reed-birds

buch experiences are continually add ing to the knowledge of humanitarian police work collected by the expert troubleshooting jacks-of-all-trades who ride the green trucks. Chosen for previous mechanical knowledge, they get postgrammate training to prepare them to face the emergeneses of a city of six millions. They are taught metal-burning with the acelyiene (orch, handling block and full shoring. knots, grappung for bodies, gas masks and gases, breaking locks, builer explasions, elevator emergencies, accidents and suitades on subway or elevated railways handling mobs and riots, Varied as is their work, most speciacular is that of extricaling men and women from the traps the great city sets for them

To a Brooklyn Hospital was brought a man whom only an immediate operation might save. They put him on the table Assistants and nurses stood by, as the surgeon bent over, knife in hand. Then the

Candle-light would not do
A moment's anguished silence
Then a stem command 'Can
the police!"
A green truck rolled up to the
bostital door. A few moments.

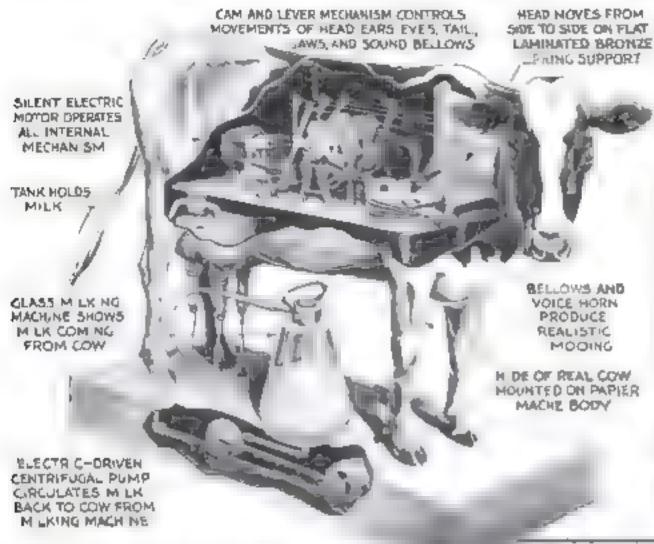
bospital door. A few moments, and the operation was proceeding under light bright as day, furnished by the same portable searchights that had revealed the borned owis.

On another night these searchughts shone upon a heap of
twisted runs. A two-story factory had collapsed. Beneath tons
of (Continued on page 94)



If it is necessary, a making a vescue from a high point on A skyseraper his gun is used by the Emergency points to shoot a rope over the building

Robot Cow Moos and Gives Milk



Fixhibit for World's

Fair the Morements

of a Living Animal

to produce the various litelist movements is illustrated by our artist a drawing. The different-shaped cama vary the speed of the movements of the tail, jaws, head, ears, and eyes to make them more realistic. Forming the support of the head is a flat it at the bronze spring that bends from sine to sale as the head moves. The sides of the mechanical cow move in and out in regular rhythm to simulate breathant.

A glass making machine make the cow, real milk coming from a tank in the udder. Spectators see it drawn through transparent tubes into the glass container. But they do not see a small centratural pump, in the pedestal upon which the arrangle status with pumps proc. It again. The cow com \$ 1000.

AN ELECTRIC cow that chews a cod, breathes, moves its head winks its eyes, most, and gives real milk will form one of the exhibits at the World's Fair next summer

This robot animal has just been completed at the New York City workshop of Messmore and Damon, specialists in creating mechanical brasts that range from prehistoric dinosaura to modern puppies. It is an exact reproduction of a Holstein mak cow the hide which covers the papier-mache body being that of the real animal. This particular Holstein was chosen as a model because it had a large black spot on one side. In the reproduction, this spot forms a door that can be removed if anything goes wrong with the mechanism inside

How a single si ent electric motor with-

Drawing above of a mechanical cow shows how at it is an mared by electrically driven mote a Springe or such gern lefe ithe movements to cheanimal shead

Mesamore and Damon with the real cow and to back of it the robot that is being made to rook just a ke it.



NEW FIRE ALARM LOCATES BLAZE

First alarms in Los Angeles, Cahf., are answered more speedily as the result of an innovation in signal apparatus. When the handle of an alarm box is pulled, the number and address of the box are auiomatically recorded upon moving tape at the central station. Reading the information from the tape, as shown at left, an attendant scierts a perforated card corresponding to the particular box and drops it in a slot. A coded signal, repeating the box number and address, as automatically transmitted by electricity to the nearest fire company, which tesponds to the alarm. The new system minimizes the possibility of error and prevents the loss of valuable time at a critical moment, as has occurred in the past, due to the firemen's ignorance of the exact location of the biaze

Gliding Cars Planned

TRAINS THAT WOULD SKIM TRACKS AT HIGH SPEEDS PROPOSED IN



Water H Judant inventor of the flying tolload with a model of the high-speed coach. The savetable property acts so a brake

MAGINE a flying radion | an which captive airplanes serve as cars. Slumming through the air, the stream had cars are expected to attain speeds up to more than 200 miles an hour A cage of rada restrains them from actually leaving the track

That is a brief out me of a project for a high-speed transportation system put forward by a New York engineer. Walter H. Judson, pioneer aviator and formerly chief engineer for a railway car manufacturer. In Judson's opinion, all engineering details have been worked out With the cooperation of makers of railway and electrical machinery, structure steelwork, and airplane equipment, he has prepared a complete plan.

Judson's plan calls for a light-weight structure of steel with a readbed of trough-shaped cross section. Two buttom rails will be faced with tubber these will support the flying car with its pressed-steel wheels, while it lightens itself with increasing speed. A pair of side rails will serve as buffers and prevent sidesway L-shaped rails at the top will complete the cage and prevent the car from lifting it self completely from the track.

The fifty-foot coach, encased in a streamlined shell of light metal allow was resemble an airpiane fuscinge shorn of wings. Wind-tunnel tests show, Judson says, that the curvature of the roof provides sufficient lift at full speed to raise nearly all of the car's weight from the

This cut away purper about the deta u of a high speed car such as as proposed for the unique tall one. Mute the goald calls and the while a that would permit the sat to rise clear of the tracks in safety.

VENTILATING

INTAKE

TOWING

rails Guide wheels with tubber tires are expected to restrain the car if it should leave the rails entirely, while similar wheels limit adeward movement

A compact grared turbine will drive the propeller. Steam is supplied from an oil-burning boiler in a rear compartment, and exhaust pleam from the turbine will pass through a condenser, enabling most of the water to be recovered and used over again

The coach Judson plans would accom-

modate from thirty-six to fifty-four passengers. Its crew would consist of pilot mechanic and porter. There is no conductor

For transcentinental service and other long haulJudson proposes the use of a flyme train of from three to ten coupled sections, instead of

the individual coach. A power car at the front would pull a string of passenger or freight-carrying sections, ending in a tapered observation car or caboose, at from 100 to 180 miles an hour Judson says. The cars will be coupled in such a way as to avoid wind drag from vacuum pockets forming between them.

Since an ordinary brake would quickly

burn out if applied to a vehicle traveling

at such speed, the propeller will be made to serve as an air brake. This will be done

STEAM TURB NE OF 750 HORSEPOWER DRIVES PROPELLER

THREE-BLADED
REVERSIBLE PITCH
PROPELLEP PROVIDE
TRACTION AND
BRAKING

CURVATURE A HUNDE ALTS LINE AIMPLANE A MUNICIPAL AMB CREATES VACUUM ABOVE CAR

A

T

THE NUMBER OF THE SECOND PAST MINING CAR

Corvainte of car's roof exerts a lift at high speeds, like an applaine a wing, labeling to make our live from the Backs.



An individual coach for abort twee and in rear a streamlined train for long battle

An attorna to signal as m, he says will make it impossible for one car to approach closer than three miles' distance to another. When a danger signal is picked up electrically from an inductor cable running along the center of the trough. the properer blades will reverse of their own accord and the steam brakes operate after the proper interval. If any foreign object falls into the runway, an emergency agnal is automatically flashed to ancoming cars and the usual action of the propeller brake is accelerated. The pilot has no signals to watch, but can talk with other cars and with the train dispotcher through a "wired wireless" system using the same conductor that carries the

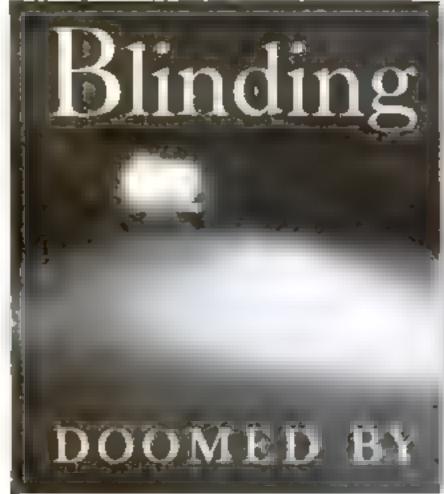
signals. These safety features and the absence of any grade crossings greatly reduce the chance of accident, Judson beheves.

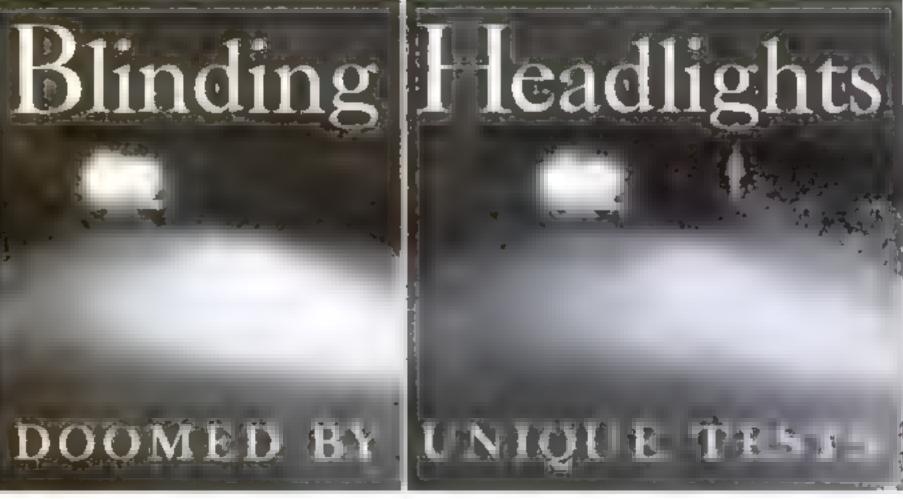
Windows will be sealed and fresh air provided by an air-conditioning system with an inlet at the front of the car-

Judson announces that a fifteen-and-ahalf-mile demonstration line is planned for New Jersey, to serve a community as yet unnamed. Both coaches and trains will be run according to the plan, and will make the trip to a terminal connecting with a New York ferry in his minutes. Commuters and sightseers, Judson says, will be offered an opportunity to use the lune, although its principal purpose is to show the feasibility of the system for larger-scale application. He declares its use would bring Chicago within five and a half bours of New York City, and Sun Francisco eighteen hours from New York,

First of the longer runs contemplated by Judson for his system are lines connecting Jetsey City and Atlantic City,

N. J., with Philadelphia, Pa-





The picture at the left was taken from a car equipped with a pate of ardinary headleghts. There is a man at the right side of the read but he is invisible. At right, the propertor so the same but camera car had asymmetrical lights and the men is seen

O LONGER need durkness take he wheel when you drive your car of night. Accurate tests have replaced haphazard judgment in designing automobile lighting equipment.

At the Nela Park Laboratories of the Ginera Liceric Comissiny Cleverano. Ohio engineers are fighting the dangers of night criving. New headlight langus are inspected and better leases neveloped. Special data travel the coals to test new cevices. Scores of spot lights, stop lights, and other righting accessories are tested each week under as use use

In the system of aghting used on some of the new cors V J Roper a Vela Park engineer sees the solution to one great night-origing danger A new hearloght arrangement known us asymmetrial I ght ng. removes the band spot turned when two cars pass each other on a dark country road.

This improved lighting system gets its name from the fact that two unsymmetrical beams of light are used. Unlike the usual pair of beadlights, asymmetrical amps are not twins. Although the left bendlamp apreads its light over the entire width of the road, the right-hand lamp concentrates its beam on the right had of the road, illuminating the adjacent ditch, curb, and sign boards as well,

For ordinary driving, both head ight beams light the roadway for several hundred feet ahead. When a car approaches from the other direction, the driver of the asymmetrically-lighted car merely touches the button of a conveniently ocated switch. Automatically, the lefthand beam is depressed or dimmed. At he same time, a second filament in the right-hand lamp, whose beam is unchanged, is thrown into play to incre-ethe light on the right side of the road. A single movement of the drivers hand lowers one beam and increases the scrength of the other so that the driver

By Walter E. Burton

can see the road clearly for several bunured feet in front of burn

because of the computated instablation and the use of two titlacy different heads high's, this particular system probably will be available only on high-priced cars. However a similar scheme that gains the some end is being applied to the less-expensive machines. It involves the use of a double thament lamp in each head ight with an ingenious provision for lowering the left side of the beam without 615turbing the right side. The lamps are so constructed that one of them lights the

right half of the roadway and the other the left balf

Auxiliary asymmetrical lights also have been designed that can be attached easily to any car having depressible-beam headlights. One simple arrangement consists of two units resembling spot lights. One light aimed straight down the tenier of the road used only when the driv ing or e-evaved lights are on The other brows a shaft of aght along the right-hand edge of the road and is turned on a ... tomatically when the headaight is depre-se l.

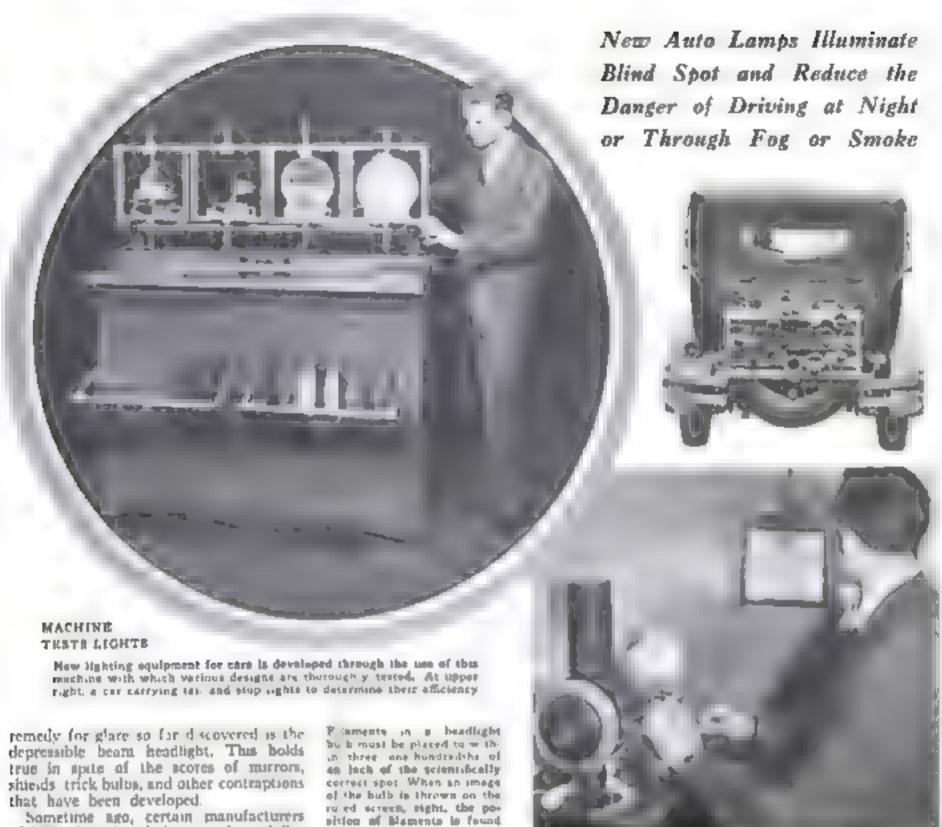
> By means of this spec aling mainment the tilt head ght is determined. the angle of the lamp teschanged outside the labor

Another supplementary system uses n two liment I it is one in vice at provides. a beam down the center of the road the other a twice that strongly I amonates the mant corb

Tests show that any head ight designed to give a good driving light frequently w), annoy other delvers. This is one to or ving concidents rather than this entitle construction. With two cars proced one hutu red teet apart, a detle tion as small as one di gree will be sufficient to glevate the hear-light beam to be eve level of the dever in the other car It does he take much how ing over mover roads to swing he headinghts of a car two or three degrees

havery year hundreds of invertors try to chrimate the eves of glate with equipment of one 3, x or and her he the liest





of bulbs introduced the use of carefullyplaced wrinkles in the bulb tip to kill the troublesome secondary images of the filement. Immediately, a small army of inventors devised mirror attachments that form intense secondary images and thus wreck the whole scientific lighting layout. Many devices fail under test because their inventors did not take into account some well-known law of optics

Great changes have taken place in headlight design. No longer is it necessary for the car owner to bother with the focus of has lamps. Improved methods of scientific lamp and reflector design have resulted

in prefocused equipment.

If you compare a new type headlight with one taken from a car two or three years old, you will notice that the reflecfor is shallower to allow a greater error in focusing without causing trouble. With modern equipment, the beam of the headright is not impaired until the lamp filament is more than six-hundredths of an inch from its true focal point. Careful design and assembling do not make an error greater than half that amount possible. Practically all the bulbs put out by reputable manufacturers fall well within the limit

To be sure that lamp bulbs are perfeet, the manufacturer tests each bulb and makes any adjustment necessary. At

sirion of Mamento is found

one stage in the construction, the filament is lighted and an image of it is projected on a scale by accurate projecting lenses. This is done while the glass bulb is still hot enough to be plastic. If the filament does not come within the allowable standand of precision, the supporting glass is moved until it does, Such a bulb is bound to give satisfactory service in a prefocused beadlight.

Nothing is more blinding than the bright beam from a headlight without a leas. This does not result from the bareness of the bulb but from the fact that a polished parabolic reflector projects a highly concentrated beam. Obviously a carefully designed lens is required to spread this beam and distribute it where it will give the most in lighting results.

Legally, the brightest portson of a headlight beam should not be greater than 50,000 candlepower A thirty-two randlepower bulb placed in an open teflector, however, may produce a spot of light of 300,000 candlepower—six times the legal maximum.

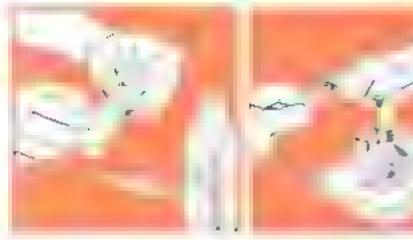
For this reason lenses must be designed by experts who place the wrinkles, ridges, and slopes where they will do the most good. In the Nela Park Laboratory, special apparatus using paper lenses accomphases this result

First, a polished silver reflector is set up in a supporting sack, silver being used in nearly all healigh's because it reflects from eighty-eight to ninety per cent of the light. Then a bulb is inserted and focused until a concentrated spot of light is clearly outlined on a screen. The front of the reflector is finally covered with a sheet of heavy paper.

With a sharp pencil, the operator then proceeds to punch holes in various parts of the paper lens. A hole at the top produces a vertical image of the hament on the screen. Another hole punched at one side forms another image, but one lying on its side. Still another hole punched directly opposite causes another lying down amage but one bearled in he other direction. Each hole that is punched forms an image to the manner of a pinhole

In this way, the engineer explores the entire plant in which the ens will res-By selecting only the lying down images, he builds the Into Pat area at the ferof the beam that illuminates the roadway some distance alread. The vertical images, on the (Continued on page 101)

Preserving and Filing



In mounting a specimen for your microscope the first step is the creating of the glass a dewith a cloth souled on a cobal



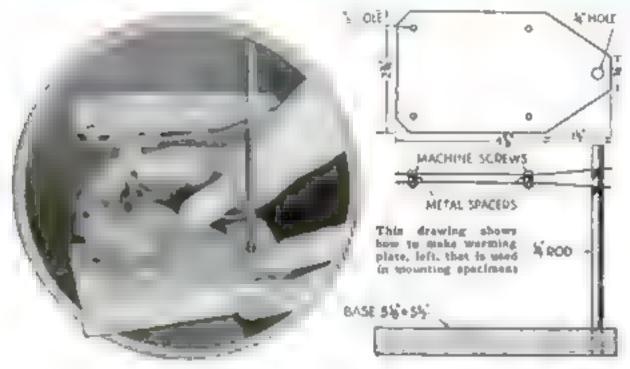
2 then last on the double-bostomed shell above the alcoholburner and left metil it is day



3 Then the slide is placed on the surretable and a brush dipped in Canada halteen or thellag in used to build a tloy circular call



4 When the cell is the right a se the spec mon which has been dried over the burner is carefully said in the center of the cell



Manner of Making Permanent Record of the World Is Described in This Article

wonderland, time and time again we come upon views so striking that we leave them with great rejuctance. It is too had that we should spend half an hour, say, in the preparation of a specimen only to take one look at it and then discard it when a little more time spent with it would make it ours for years to come.

I believe that many of my readers will like to build for themselves a wonder album, a collection of microscopic views and specimens that can be preserved permanently. This is not only a most interesting indoor sport but it makes our work with the microscope useful and instructive. Also, it permits our family and friends to see what we have seen and to marvel with us.

In an earlier installment, you were told how to make a little device to be used in placing circles of Canada balsam upon skp glasses—the little three by one inch windows upon which we have been placing our specimens for examination and which may be bought cheaply at any biological supply house. This device will be needed along with the scalpel the needles, cover glasses, and a small camel a bair brush of good quality.

Also, we shall need a little alcohol burner and a drying plate such as is illustrated here. This is easy to make The double bottom is my own idea. It prevents too rapid heating for, except in rare cases, the topmost piece of metal should not be made too hot to touch with the finger. We shall also want some black asphaltum varioush and some white or clear shellac. With this modest outfit, the beginner may do creditable work in the preservation of specimens.

A word of caution Don't harry. Keep in mind that you are mounting the specimens to last, and it is necessary to

By BORDEN HALL

be careful. Above all, remember that monsture and air bubbles must be climinated. A slide in which there is moisture well not last and is useless. If we are going to prepare streemens at an they are worth preparing well and we show I nut forget that we are learning to do a work that today has a great deal of industrial value. Perhaps if we become proficient in mounting specimens we may be able to continue the work with some great corporation that is constantly trying to improve its product. A great flour mill in Minneapolis, Minn., for example, proudly exhibits more than 30,000 microscopic slides; the result of an in-vestigation that has extended over a period of years and has lowered the production costs and increased the nutritive value of its products

In a dozen research laboratories today, milk is exposed to powerful ultra-violet light. Then microscopic experts count the dead bodies of the tubercular bactin to determine the killing power of the rays. Today, the microscope is an indispensable and to industry

Our job at present, however, is to prepare a specimen and for our first effort we select what is known as a dry specimen. If we were going to mount the body of a dog flex, we should be dealing with a wet specimen and an entirely different technique would be necessary. To start with, we use the wing of a fly.

The stide and cover glass are carefully cleaned by sponging them off with a piece of soft cloth, free from lint, soaked in alcohol. The slide and glass are then placed on the little warming pan and left there for half an hour. Next the slide is lifted off and placed on the turntable so that the center of the slide is over the shaft of the table. This automatically centers the mounting of the specimen Under no incumstances should the center portion of the slide be touched with the fingers or any other object after it has been cleaned and dried.

Microscope Specimens



5 With the specimen in piece, glass is placed, with the forcops, on top of the battam wall



The turntable is then given 4 6 ap n and a brush that has been dipped in aspha tum is he d so it sea a edge of cover giars





apecimens are always readily

on to your vis ting friends

The little camel's hair brush is dipped into the Canada balsam, which has been dissolved in chloroform, unless you secured your supply from a biological supply house, in which case it was already dissolved. With one hand, the brush is held over the slide at the position near which we wish to mount the specimen. The other hand is used to turn the table. The tip of the brush is brought in contact with the moving table at a point far enough from the center to describe a circle a little larger than the cover glass. These cover glasses are usually \$ath of an inch in d'ameter, although d'herent sizes may be oblamed

In this way we make what is known as a ce i. The tiny circle of bassam but is up a low wall that will support the cover giasa and enclose our specimen. The height of the wall depends upon the amount of balsam we deposited with the brush. If the specimen is thick, we shall have to build our wall higher by letting the first ring of balsam dry and then placing another ring on top of it. In this way, we boild up a series of rings until the proper height is reached. That is, until the wall is so high that when the cover glass is put on it will not crush the specimen.

Before a second layer of balsam is added, the first layer should be thoroughly dried by placing the glass slide in a little metal box, free from dust, and then putting it over our little beating pan We must not forget that we are dealing with objects for the microscope and that if we permit a speck of dust to get into the cell, the microscope will make it look as large as the moon. Then, too, such specks are always the sign of the

poor werkman.

The specimen must be free from moisture. To insure this, we leave it for a few minutes over our little alcohol heater protecting it from direct heat by placing it upon a clean slip of glass. While this is drying the inside of the cell is covered with a thin layer of balsam which is permitted to become fust tacky. Quickly the fly's wing is lifted with the forceps and placed in the center of the cell. The cover glass is picked up and placed over the wing on top of the wall balsam and the slip glass is repaced on the turntable. A sebrush is then dipped in the black asphaltum varnish and the table is spun while the loaded brush is held so that it overlaps the edges of the cover glass and seals the specimen in. Several turns may be necessary to deposit the right amount of varnish but once done and dried, we have our fly's wing locked to so it will keep for years

This may sound like p 'work but I have been careful to outline the process in detail. Act ally doing it is much more inter-



BUXES FOR YOUR SPECIMENS

You can make your new boses for glass slides by following directions given in this drawing esting than the description. When he ingers become tra not and you have developed a certain amount of skill, you can mount several specimens at a time, so arranging your work that one thing may be sealed while another is drying.

One big mistake the beginner may make is that of using bits of a specimen that are too large. This is the result of our inexperience as we are unirained for work in a world where tiny things are so large. A friend of mine once placed a piece of fungus, the size of a ten cent piece under a sade when he should have used a bit the size of a penhead

Our next job is to mount an opaque specimen, that is, one that must be studied with reflected lights her vistance if we want to mount the inside of a beesse's wing, which is opaque, we cannot proceed exactly as we did in preparing the fix s wing. The cell however is built up in the same manner as before. But after the last application of balsam bas dried, a small brushful of black asphalturn is placed inside the wall of balsam While the asphaltum is soilt tacky the specimen, after having been carefully dried, or dehydrated by the appointion of slow heat, is lifted with the forceps and put in place. The rest of the procedure is the same as that described for the brst mounting

Also, it may (Continued on page 94)

Crime Studied in U. S. Research Laboratory



The broad where letters, seen here, are the sble by day' ght but show clearly under o't a violet lamps that detect the nearth writing

Government criminologists will neek new methods of some inc crime detection at a research laboratory just established by the U.S. Bureau of Investigation of the Department of Justice. A formulable array of technical appointus has been assembled in the guarded laboratory, in-

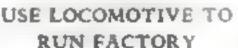
cluding such varied objects as microscopes, ultra-violet lamps, and sensitive calibrating instruments for measuring the bore of guns. One of the most curious pieces of apparatus that meets the eye of a visitor is an illuminated cabinet in which the fingerprints of a criminal suspect may be compared with those of a known criminal. When the two prints are laid side by side at the back of the cabinet, enlarged images of both are thrown on a acreen. The images are so justaposed that the lines of one print are seen merging straight into those of the other, permitting instant comparison.



WALLPAPER NOW MADE OF SPUN GLASS

Wallpaper made by spreading fine spun-glass fibers on a paper foundation is now available. The fibers are laid in one direction and the affect on the eye is that of a multitude of fine parallel lines of shuly bridging. Before being applied to the paper the glass is permanently dyed. Fibers of various rotors applied to the same foundation result in gradations of color in bands that blend into one another. It is supplied in standard rolls.

4



WHEN two boilers of a Newark, Ohio, refinery had to be taken out of service. simultaneously for repairs, the company engineer averted an expensive shut-down by using a locomotive to provide emergency steam, The engine, rented from a nearby railroad shop, was run on a siding beside the plant. Piston and cylinder head were removed, permiting the steam to be drawn off for use in the refinery A temporary smokestack and a traveling-bucket coal loader completed the conversion. For two weeks, the locomotive ran the plant



EXERCISE EARS TO RESTORE HEARING

An EAR gymnasium, devised by a Michigan inventor, is said to said those of defective hearing by exercising the nerve centers of the car. Special earphones are slipped over the patient shead and at the tone frequencies at which hearing is defective, a series of tone exercises is given at a volume great enough to be heard by the patient. Over a peroid of time, this is said to improve the hearing.



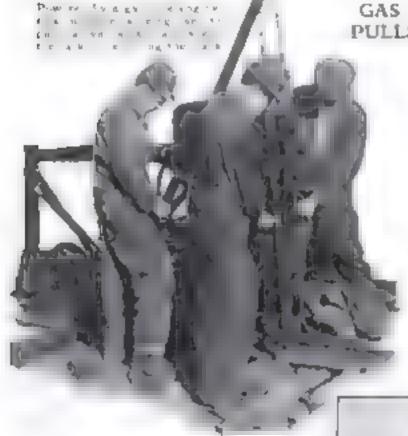
ABANDONED LEAD MINE TURNED INTO MUSHROOM FARM

On a piece of ground 200 feet beneath the earth's surface, Dick Wills of Marni, Oxla., is growing regular crops of mushrooms. His unusual farm is the passageway of an abandoned lead and sinc mine,

where he found a suitable temperature practically constant the year ground. The farm hands wear regulation miners' contumes, even to the small carbide lamps on their heads, for the mushrooms thrive best in darkness. Fifty pounds are harvested daily. A royalty is paid to the owner of the land, an Indian who is delighted at the resumption of his income since the mino itself petered out,



ONE of the bardest jobs in the work of removing long lengths of railroad track has been the back-breaking one of pulling spakes with the old-fashiuned claw bar Now a machine bas been developed that pulls spikes at the rate of twenty-five a minute with slight effort on the part of the operators. As the machine is moved from tie to tie by operating a crank and chain drive at the side, one of the operators slips tong javes over the spike head and a book on a lifting arm engages the lug on the tongs, The lifting arm is operated from a gasoline engine



GEOMETRICAL DESIGNS DRAWN WITH TOY

Thousands of geometrical designs, no two exactly alike, may be produced with a toy recently placed on the market. This instrument, an ancient device in modern guise, employs a rotating turntable bearing a sheet of drawing paper and spun with a crank, A pencil in a swinging mount traces the design, as shown at right. Moving certain pega varies the pattern, which when completed is suitable for coloring with a set of crayons. The arcs produced by the motion of turntable and pencil result in tracings of surprising beauty.



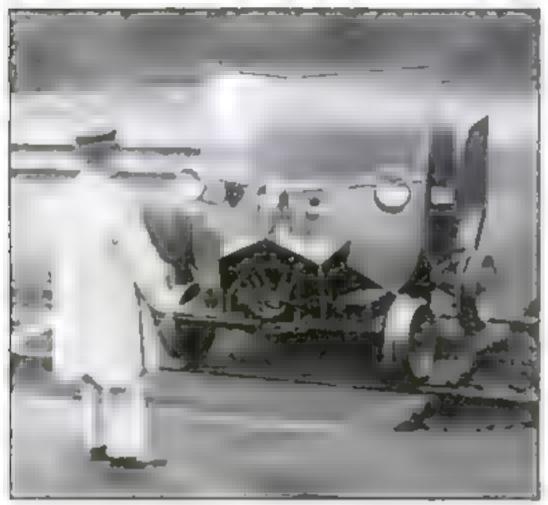


Amazera movie-making enthusiasts may prepare their own titles, including animated ones, with the aid of a new title writer. This device, an illuminated stand with an easel at front and a place for the camera at the rear, works in three positions. When set at an angle, as shown above, it permits a hand to be photographed drawing a title. A vertical setting films movable letters for an animated title,

X-RAY FOR WAR USE

FIGHTING airplanes with X-rays was a possibility foretast recently when Dr. J. W. M. du Mond of the California Institute of Technology, discharged an electroscope 100 feet away with an X-ray tube. Eventually, he said, the ray might be used to disable hostile aircraft.

Auto on Rails Used by Track Inspector



A fiverin vehicle, sharing the appearance of an automobile and a railroad handcar, is used by a Danish railway official in making his regular inspections of the road. Florged wheels adapt the car to travel on the track, while a gasoline motor propels it at a lively pace. Headlights, horn, and a large windshield complete its equipment. The photograph at the left shows the unusual inspection car about to be placed upon the rails

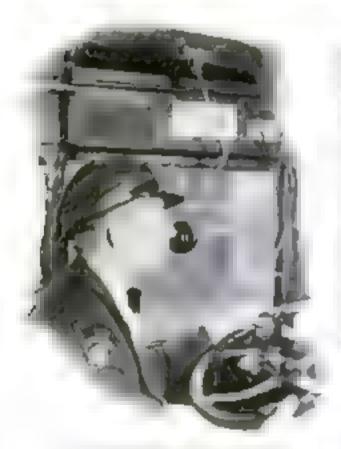
NEW BRICKS HOLD NAILS

NAMES may be drive en in o novel building bricks of clay developed by a Los Angeles Calif., inventor and recently placed on the market. This innovation in home building material makes it possible to nail interior fittings directly to the wall The new brick, half the weight of the standard type, is said to have buch beat insulating value



As photo shows, no a may be do yes onto this new building brick we hout cracking it

RECORD FISH HAUL FROM DRY DOCK



LOUDSPEAKER IN BUS CALLS STREET STOPS

Calling out street stops is made easy for the driver of a double-deck bus equipped with a new annuuncing sysery developed by Bell Telephone Laborafory engineers. When he speaks into a movable microphone shown in the photograph above, his voice is made audible by loudspeakers at the back of the bus and on the upper deck. No passenger anywhere in the vehicle can fail to hear him The microphone, which operates from the car a battery, may be pushed aside when not in use. Since standard switches are not suitable for use on the bus, a new foot operated switch has been designed and is attached in a convenient position. on the floor



When this dry dock was emptied it was found the troughs beside hee! blocks were filled with fish. Picture in circle, shows how men gathered them, it hashels and loaded them nio hosts



PHOTO-ELECTRIC CELL GAGES STAR'S LIGHT

What probably is the most sensitive instrument of its kind, for measuring and comparing the brightness of faint stars, has been perfected by Dr. Albert E. Whitford, University of Wisconsin astronomer, The light of the star is trained upon a photo-electric cell within a orass cylinder at the end of the released shown in the picture above. The electric impulse produced by the cell is ampuned more than 2,000,000 times by the cabinet, resembling a radio set seen in the foreground. The ampuned current swings a pencil of bight across a scale and the distance traveled by the light beam is proportional to star's brightness.

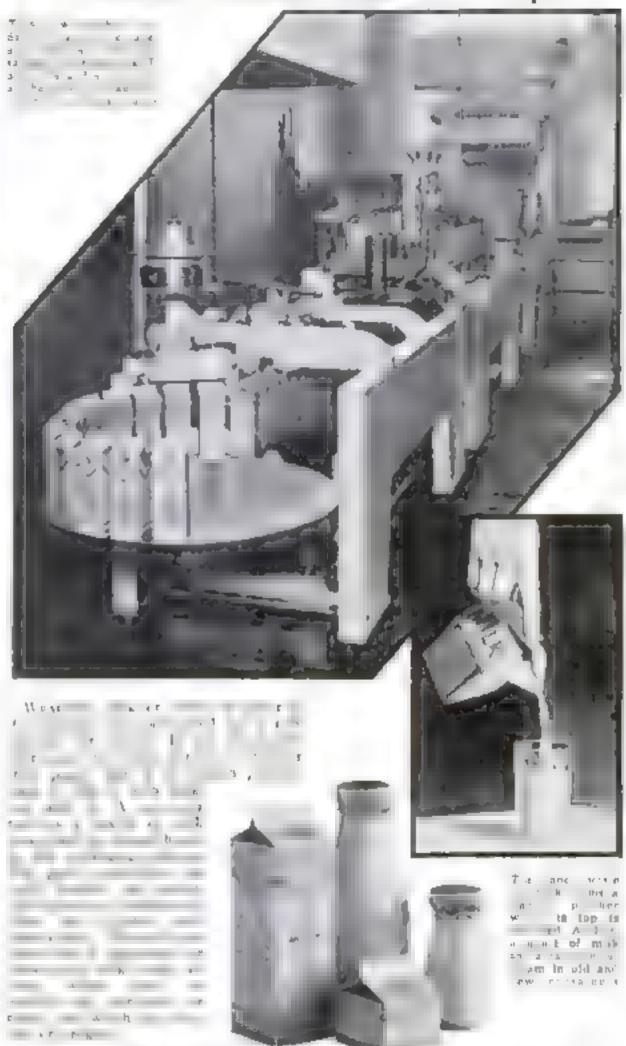
NEW HIGH SPEED LENS BIGGER THAN CAMERA

A new lens produced in Germany larger than a pocket camera, admits sufficient light to take snapshots by ordinary incandescent buibs. In the rating customarily used by photographers, the speed of the lens is classed as F/O.93; this means that it will make a fully-exposed picture in less than a twentieth of the time required by the F/4.5 lens of a modern high-speed camera. When the lens is installed on a pocket camera, a telescopic sight is used with it.



The big lens used with the camera is so fast fit takes anapabots by the light of ordinary builds

Machine Bottles Milk in Paper



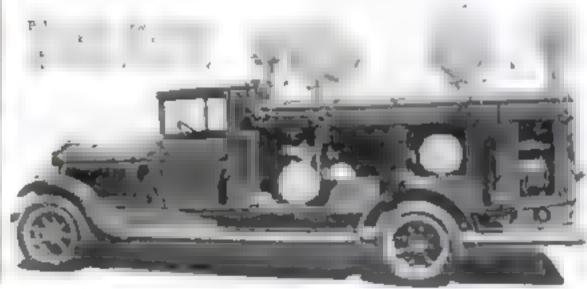
NEW SCREWDRIVER IS SPARK PLUG TESTER



Fire Truck's Lights Turn Night to Day

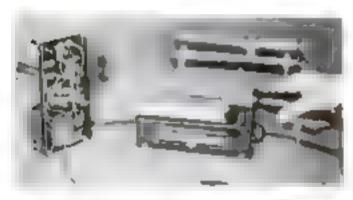
An Extraorphysics array of lighting equipment is concentrated upon a single emergency truck, recently placed in service by the fire department of Beaumont, Texas, It carnes sixteen floodlight projectors and can be rushed to the scene of an alarm to illuminate a

building as brightly as day for fire-fighting and rescue work. Six fixed projectors, one throwing a one mile beam, may be raised and lowered within a vertical range of five feet by telescopic mountings on the truck. Electricity to run the lights is supplied by a portable generator that is carried in the body of the truck.



Water Holes Help in Fight on Canadian Fires

With R holes, are the one il near to lat the right, now help course, tores, tires along highways on the northern from ser a littlesh traduction. So was a trace brever the salety of meanists terest rangers histor to the nearest rongered, and act up a portal e gase mediven pump in the manner shown. The aream it delivers from a hose proves an effective means to check a fire before it assumes dangerous proper tons. A cham of water boles has been less out in such a way that the main ar cries of travel are all processes.



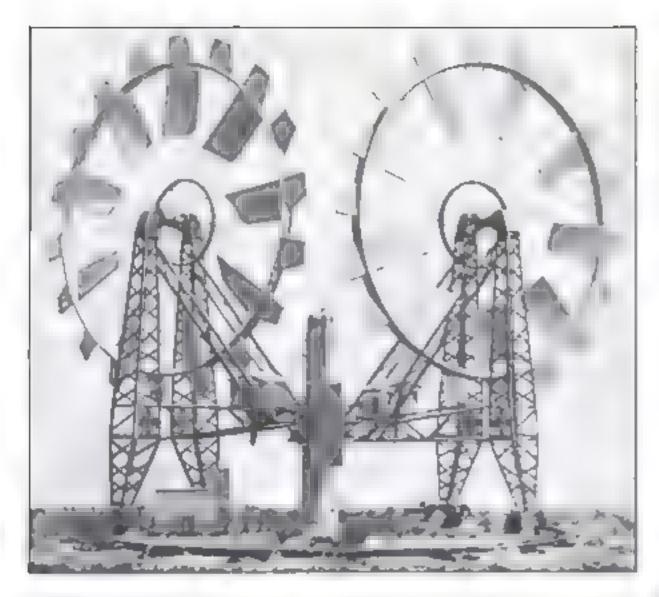
SOLDERING IRON STAND REGULATES THE HEAT

KEEPING & soldering iron at just the desired best is the service performed by a new stand, which comprises two cradles. When the iron is first connected, it is placed in a cradle marked "Hot Iron." Here the full voltage is applied to the iron and it heats up rapidly. Once the from is heated, and again between soldering operations, the tool is laid on the second gradle, marked "Warm Iron," The weight of the mon, in this cradle, automatically introduces an electric resistance into the circuit and cuts down the amount of current to a point just enough to keep the iron hot. Stand and accessories are shown above.



FAST ABRASIVE WHEEL SMOOTHS CASTINGS

Serience so fast that its surface travels at more than 100 miles an hour, an abrasive wheel, in the machine pictured at left, removes stags or projections from heavy castings. Removing these blemishes, usually the result of an imperiect mold, has hitherto been considered a troublesome operation, but the new machine, with its single operator, makes short work of them. A bonding material of great strength, developed through recent research, holds the wheel together and enables it to rotate safety at high speed.



TWIN WINDMILLS RUN ON ROUND TRACK

Twin towers would barness the wind in a giant type of windmill proposed by a Frankfort, Germany, engineer, who has embodied his idea in the model illustrated above. Instead of pivoting the windmill disks on a vertical shaft to awing into the wind, he would support them with carrages on a circular track 260 feet in diameter In this way, the inventor maintains, the two wheels would awing around automatically to obtain the maximum power from wind in any direction.



RUBBER IN PASTE FORM

St PPLIED in tubes like toothpaste, a new form of rubber, of
paste-like consistency, hardens after expusure to air. The product has
a wide variety of uses, particularly
for mending. As shown at the left,
it may be used for patching the
sole of a shoe Industrial users also
find the material adapted for such
purposes as packing the stuffingbases of valves.

LEVER LOWERS CAR'S REAR CURTAIN



CAR OWNERS CAN now have a control that operates the rear curtain from the drayera seat. A amall lever is set in the car body within easy reach, just above the left-hand window. By moving it along a slot, as illustrated at the left, the driver may lower the curtain whenever lights from the rear amony him. In case he wishes to have the rear window unphstructed be can raise the blind by working the lever.

FLEXIBLE STOPPER CUTS OFF FLOW OF GAS

Ast excessions stopper, devised by a New York inventor, if. L. Peden, permits the flow of gas in a main to be cut off temporarily at any point during repairs. The stopper, a collapsible disk of devible material, is inserted in the main through a tap hole. When a crank is turned, a metal cable draws the prag into a vertical position and expands it so that it fits stugly around the inside of the pipe wall. Once placed, the stopper is locked to prevent slipping or blowing out,





NEW RE-THREADING DIE

Machinists know the difficulty of starting a one-piece die in order to cut new threads on a bolt, when the old ones have been damaged. A new re-threading die, hinged in two pieces, may be appued to the threads at some distance from the point of damage as shown above. With the aid of a special ratchet stock, the die is then worked off the bolt, repairing the mutilated threads by a back-cutting movement instead of an advancing cut.





This diagram shows he position of the star rlock a hand a drawn from the pulsmar to the polerers of the Big Dipper at mine o'clock on Just 1 and mina the position of this I me ata hours after A lost by pairing a ruper. hand to the umbre a chat been a your ater map, the position of the star cluck a land to coastly hope in mind

ACPPOSE you are steeping on under he stars in a vacation camp some might next summer. For convensence, imagine that it is July 1. You awake and wonder what time it is,

A glance at your radium west watch tells you it has stopped. You forgot to wind it. You think it must be some time between midnight and morning, but you

are vague as to the exact bour.

In such a situation would it occur to you to consult the Great Star Clock in the northern sky? It tells time to the whole warld through every clear night of he year but almost no one ever consults t. Yet it is to in their to the consuprest. one it is nited one by he is is Sometimes as in the World War, it might mean a difference between life and death.

Once you have searned in the line bond of he circa. Yard, ak at hes more to of the year the me how is sim, in Let us see how it works on the mucht of next

16 1 1

On this particular even by hour time o clock, you would see the Big Dipper hanging down a the left of he poleman The I oper looks as if I were hanging as its handle from a nail. If you draw an imaginary line through the dipper's pointer stars and he polesiar the line will run horizontally from west to east. This line is the hand of the Great Star Clock. A paper hand cut out any stack to the ambrella fabric as shown in the diastrations, will help to keep the various posttions of the star clock's hand clearly in mand

Now suppose that you had known that the dipper bangs on its nail at the left of the pole at nine P M What difference would a have made to you when you woke and found your watch stopped?

It would have made just this differprice-year would have been able to tell the lime of right to writin a few minutes. of wall bacteries by a glance at the position of the star clocks

Suppose, for instance, that when you woke the hand pointed straight down from the polestar to the horizon, where the dipper stood solidly on its bottom. What bour would that indicate?

Remember the dipper makes a complete revolution around the pole in twenty-four hours. How far, approximately, would it turn in six hours? Obviously, a quarter way round. And since the hand it your war clock has also travelled a quarter way, it is plainly nine o clock plus six hours, of three A a

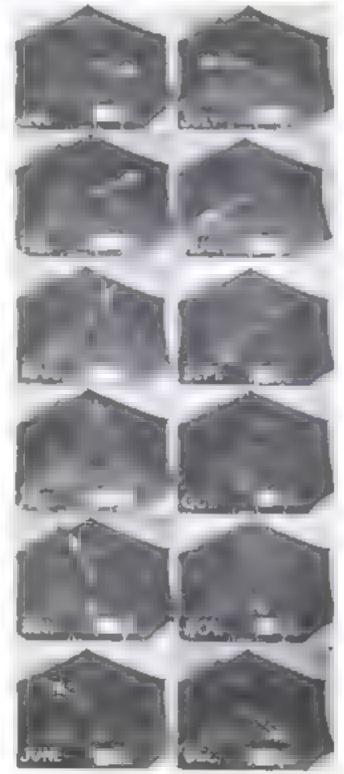
If you wish, you can imagine toe I e of the sair clock divided into tweeve parts like the dial of your waich but you in its remember that each of these twelve divisions is territy equal to the a bours. In other words you must even uply days e the dial anto twenty-four parts, for he hand requires nearly twen yfour hours to traverse the entre careur!

You have been wondering, probably why I used the word nearly in the last two septences It was necessary because the dipper actually completes its circuit of the

THIS CLOCK NEVER RUNS DOWN



The illustrations at tight show the posttion of the star clock hand at a ne a lock on the frat evening of es h the hand turns in a counterclockw se direct on and to one though it moves onetwellth of carele's entirecircumlerence



By Gaylord Johnson

by the STARS

Clock in the Heavens Easily Read on Any Clear Night, Any Place in Northern Hemisphere, if a Few Facts Are Learned and Kept Constantly in Mind

pole in a little less than twenty-four hours. To be exact, the star clock's hand comes round to the same point again in twenty-three hours, fifty-six minutes and four seconds. If the dipper starts at 9 P M, from its position at the left of the pole, it will be back in the same position the next evening at three minutes and fifty-six seconds before nine o'clock.

This daily gam of a distance requiring about four minutes to cover has an interesting result. It means that in thirty days the star clock's hand has gamed a distance which it requires two hours to traverse. This space is just equal to one-twelfth the distance round the dial? You can see at once that the hand will occupy a different position for every month. Our star clock has now turned into a star calendar

In the illustration of our umbrella sky on this page, are shown the position the stor clock a hand occupies on the first of every month at nine o'clock in the evening. As you become familiar with the nine o'clock positions of the dipper in the various months, it becomes a simple

matter to calculate the hour from any other position you may observe in the

The only difficulty in telling time accurately by the stars lies in judging the angle the hand of the clock makes with a vertical or horizonial line. The best way to do this is to hang a cane from the fingers of one hand so that its edge just touches the polestar. Then a pencil is placed at right angles to the cane so that the star rests exactly in the angle thus formed. This makes it easy to note the slant of the line from the disper's pointers to the polestar—and to estimate the angle by which the hand differs from its position at nine F.M. for that month.

For rough guessing at the hours, a right angle formed with the index fingers of both hands will do for estimating the slant of the clock's hand.

It is quite generally known that the standard time which guides all out daily activates is obtained directly from the stars in a Government Observatory in Washington D. C. but not many people know hat it is possible for anyone to

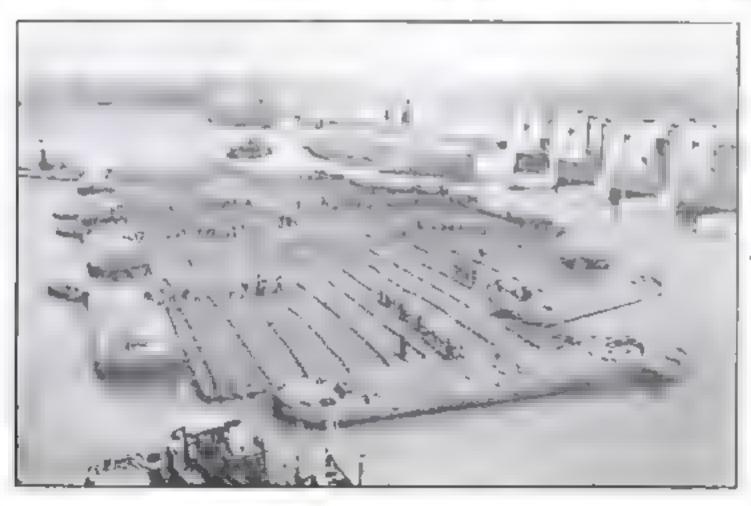


By eighting accurately the disappearance of a six behind a given object in this case a triangle of paper, at a definite hour each evening, but can check the governey of you each a nee the attack the governey of you each a nee the attack will vanish three minutes and fifty-six accords earlier each pight

regulate a clock or watch by the stars. No clock that man has been able to build compares in accuracy with the Great Star Clock of the heavens. Even the superb clocks in an observatory must therefore be checked by watching the times at which certain stars cross the senith point of the observatory's location.

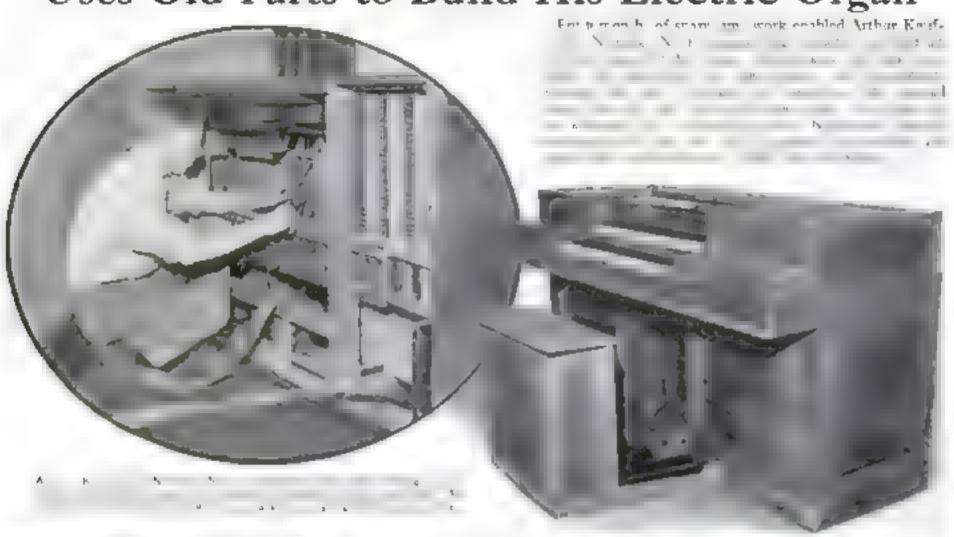
The astronomer in charge of this work knows that any star will arrive at the senith point (he calls it the meridian) at three minutes and fifty-six seconds earlier each night. If the observatory clock should say that a star passes the meridian at only three minutes, fifty-we and mine-tenths seconds before the one of its meridian passage on the previous night, then the (Continued on page 1-1)

Rafts, Loaded with Rock, Save Holland's Great Dike



WHEN the great dike that Horand has erected to shut off the Zuyder Zee from the North Sea was recently threatened with collapse, Lg rufts, like the one juctured at the left, were pressed into service to save it. Heavy ramfall had swol en the currents passing through the sluice gates, and scoured but deep holes in the dike s foundation. To plug the holes, buge rafts were floated to the site, loaded with rocks, and sunk, Other unforeseen events have followed the shutting off of the Zuyder Zee. Coincident with the monster engineering project, fishermen declare their catches of flounder greater than ever before, though the reason is not known. German scientists say the dam has caused earthquakes,

Uses Old Parts to Build His Electric Organ





PORTABLE BABY HOLDER

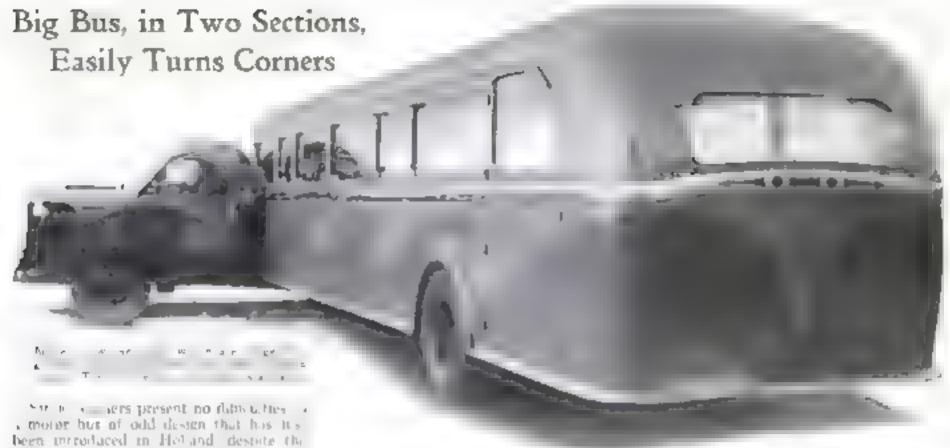
Bany is kept sale and comfortable, at home or on a drive, by the demountable sent illustrated above. Is spring have a curving bar of strong steel in a secure y in a metal slot, of which any desired number are provided. One may be permanently installed in a car's front compartment and a second in the rear; others may be placed on the porch and in various rooms of the home

MINE SILVER IN STUDIO

MINING for selver in a Hollywood movic and to has welfed 60,000 troy ounces values at \$17,000, in six months. The procious silver is recovered electrically from baths that dissolve silver salts during development processes.

MODEL AUTOS TEST LIGHTING PROBLEM





the term of odd design that has its been introduced in Heland despite the large size of the fifty-live-passenger vehicle, his forward end is hinged to the rear, and the two sections pivot in rounding a turn. To a speciator of the remark-

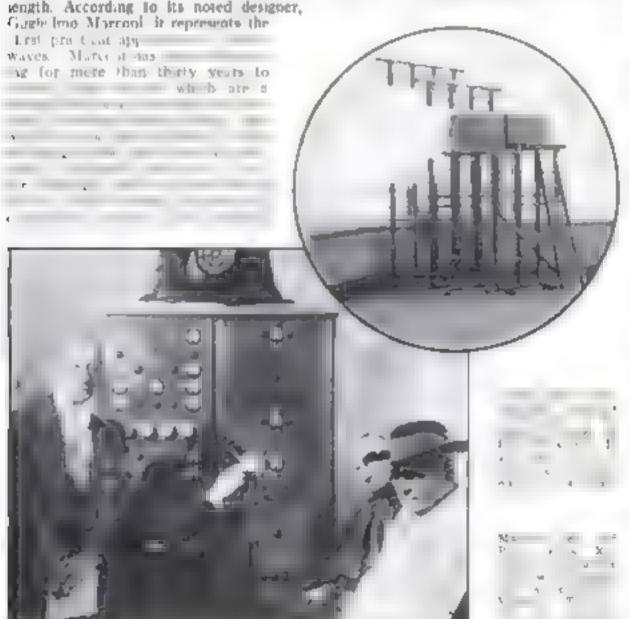
able evolution, the bus appears to turn around and look at uself, as seen in the photograph above. Power is transmitted

from the engine to the front wheels through a driving mechanism especially designed for the folding bus

ULTRA-SHORT-WAVE RADIO AT VATICAN

AN LETRA-RHORT-WAVE todio station has been installed at Vatican City, Italy for communication between the Vatican and the summer residence of Pupe Pius XI at Castel Gancolfo, twenty miles away The set uses waves only fifty-seven centimeters (about twenty-one inches) in length. According to its noted designer, Gugir Imp Marconi it represents the

it was supposed that ultra-short waves could not be used for long-distance transmission because they would not follow the curvature of the earth's surface. In a test last year, however Marconi succeeded in sending a one-way message 167 miles on a twenty-one inch wave



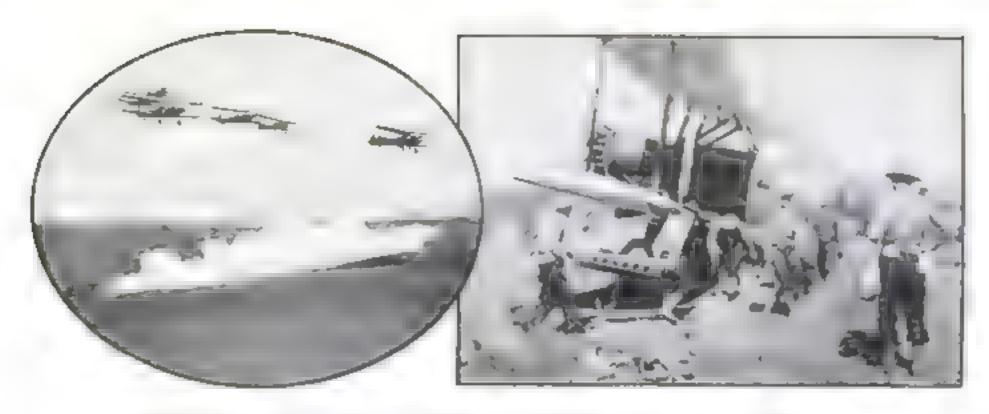


NEW BEDSIDE LAMP HAS ADJUSTABLE SHADE

ADJUSTABLE openings in the sides and bottom of a new lamp shade, for bedside or sickroom use, regulate the illumination according to the user's wishes. The apertures on each side are uncovered to the desired extent by turning a knob attached to a shutler. Those on the bottom panel may be adjusted similarly, or the panel may be slid out entirely to provide a light of full strength.

UNSALABLE ORANGES NOW MADE INTO GUMDROPS

Gustmors from prange trees is the most recent development in the effort of orange growers to make use of all the by-products of their groves. The new gumdrops are made of the fruit pectio, a jelly-like white compound derived from the unsalable oranges. Last year, confectioners purchased fifty thousand dollars worth of pectin from orange growers.



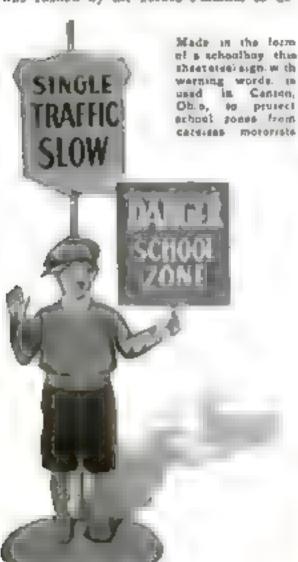
Men and Howitzers Moved in Big Bombing Planes

An experiment first tried two years ago was repeated recently on larger scale when an entire battalion of field artillery was rushed by air across Panama to de-

fend the canal against an Imaginary enemy. Men and bowitzers boarded ten big bombers (upper right) at Bejuco and were whisked to La Chorrera at 100-mile-an-

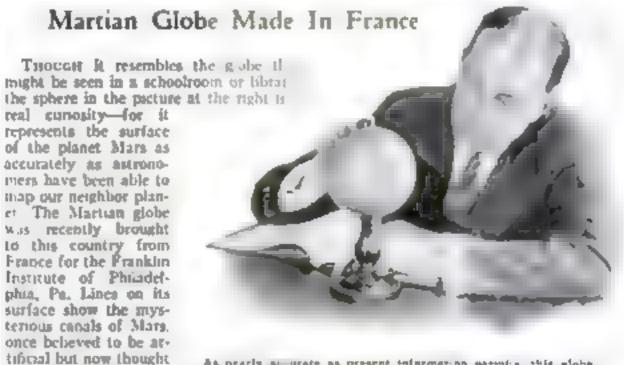
natural markings

bour speed. A few minutes after the landing, the guns were set up and in action, while the bombers (upper left) were headed back toward their base



STEEL FIGURE OF BOY GUARDS SCHOOL ZONE

Mororists passing through the school zones of Canton, O., are reminded to watch out for the safety of children by arresting signs piaced in the center of the highways. Each of the unusual signals represents the figure of a schoolboy with upraised band, and is conspicuously painted in black and orange. One of these sheet-steel signs on its iron base is placed a block and a half away on each side of the school, where it provides an effective warning to careless drivers.



As nearly as wrate as present information permits this globe made in France above the aurince conditions of planet Mars

MAGIC LANTERN HAS POWERFUL LIGHTS

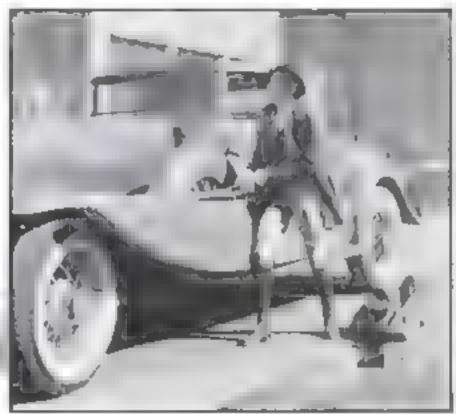


SHAPED like a warm-air furnace, a powerful projector has been designed by a German firm for throwing enlarged images of opaque objects on a screen. It u especially suitable for use in schools, colleges, and lecture halis. It requires little floor space and is so designed that it does not obstruct the view of those near it. Light is provided by four 500-watt electric buibs. An ingenious water-cooling system prevents overheating of the objects displayed. So great in the light-transmitting power of the projection lenses that pictures and type on white paper, such as a page of this magazine, may be projected clearly in a room only partially darkened. An attachment permits the exhibition of transparent alides and well lighted color photographs.

FOLDING BOAT EASILY CARRIED



This boat big somigh for three fulds flat so it can be carried by care successing board as is above; in photo 41 upper light



while one a may carry it the amount of the following the sides down, the center and the pieces says into sons

ANTI-ROLLING BRAKE HOLDS CAR



INK PAD NEVER DRY

Cases of rubber stamps will had the appearance of a new stamp pad that never goes dry. An ink reservoir, replenished through the filler tube visible in the photograph above, keeps the surface supplied.

WIND POWER TUBE NOW IS DESERT MONUMENT

White barnessing the wind for power continues to be a favorite project of inventors, few reades such a scheme once actually reached the point of construction on a windy desert in southern Canfornia. An abandoned steel tube, sarly feet long and four feet in diameter, stall stands on a circular track—a monument to an inventor's dream of cheap power. Propellers within the tube were coupled to a dynamo at the small end, Tests were disappointing; the maximum output, it is reported, scarcely exceeded half a borsepower.

As anti-notting brake, devised by an Eigin, Ill, inventor, aids motorists in parking on a hill or in stirting a car on an ungrade Equipped with this device a car cannot slide backward when the regular brakes are released. An automatic control running from the transmission to the anti-rolling brake automatically throws the latter out of operation when the car is put in reverse gear. The secret of the device is 0 brake above that locks against the drum



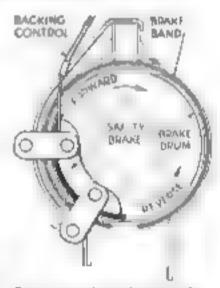


Diagram explains the principle of the anti-rolling brake which is seen in photo at left. The brake boids car on a hillaids



On a windswept desert in Southern California, an attempt was made to harness the wind for power. This abundance steel tube is all has is loft of the project which failed to work

TESTS

You Can Make with LIGHT and Chemicals

HEX you map the shotter of your camera, you perform a chemical experiment. A sensitive chemical on the film is decomposed by the light that streaks through the opened abutter

Like heat, light causes many substances to change and on this fact hinges the study

of photochemistry.

Red mercuric oxide, for instance, is a common light-sensitive chemical and the amateur can demonstrate this fact by dissolving a small amount of it in a few drops of water and an equal quantity of glue. By spreading or brushing the resulting solution on the clean surface of a white piece of cardboard, a simple light-sensitive firm can be made

Unexposed, the card has a fight pink color but as soon as light is allowed to strike its surface, the sensitive film turns to a dark brown. The light causes the

mercuric oxide to decompose.

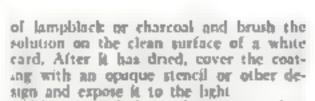
With a film of this type, the experimenter can make copies of stencils or other opaque designs by placing the original on top of the sensitized surface and exposing it to the sun. The uncovered portions of the card will turn brown while the great protected by the design will remain pink.

Another mexpensive light-sensitive mixture can be made from potassium dichromate (often referred to as potassium bichromate) and glos or gelatin. Differing from the preceding experiment with the mercuric oxide, the chemical in this mixture changes the solubility of the glue when it is exposed to the light.

Glue, as we know, can be redusoived in water after it has hardened. However, if potassium dichromate is added to it and the solution is a lowed to dry under a light, it can not be rep-ssorved

By making use of this odd property, the home chemist can perform an interesting experiment. Dissolve a purch or two of powdered potassium dichromate in about one-stateenth of a glass of water (one-half ounce) and stir in a half teaspoonful of liquid glue or household gelatin that has been soaked in water. When this has been mixed, add a small amount

If washing node is dusted about the air strake of a Bunner burner, us in shown as a ght, blue copper tulphote crystals will appear buck, due to the change in the color of the Same produced by the weshing node dust

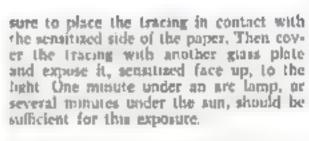


After several days of exposure, place the card in water. The portions of the card covered by the stencil and unexposed to the light will wash off while the exposed areas will remain to form a perfect image. The portions exposed to the light are no longer soluble in water

From inexpensive chemicals, the home experimenter also can make his own sensitized blueprint paper. The two chemicals needed are from (ferric) ammonium citate and polassium ferricyanide (not ferrocyanide). Place about an inch of the territ ammonium citrate in a lest tube six inches long and three-quarters of an inch in diameter and fill the tube with water. In a second tube, place half an each of the polassium ferricyanide and fill it with water, in a dark room, shake both tubes to dissulve the chemicals and then mix the two solutions.

THE paper to be sensitized can be coated with a brush or it can be immersed directly in the solution. An excellent coating brush can be made by building some strips of cotton cloth to the end of a glass interescope slide. After thoroughly coating the paper, hang it up to dry in a dark room. Incidentally sensitized papers should, of course, he kept in the dark until they are ready for exposure

To make a blueprint with your bomemade paper, place the prepared sheet on a glass plate and cover it with the design to be copied which is generally a transparent tracing made in black ink, Be



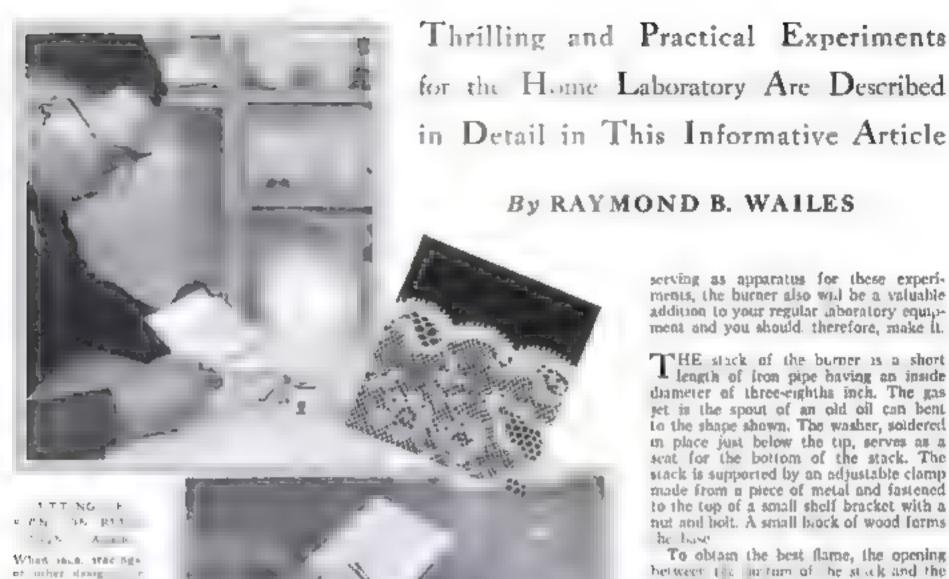
WHEN the exposure has been completed, take your improvised printing frame into a dark room and remove the paper. A copy of the design or tracing will be plainly visible. Wash out the remaining chemicals on the surface and allow the sheet to dry. The finished blueprint will be an exact copy in white lines on a blue background.

The process of blueprinting is entirely chemical. The light reduces or changes the feeric ammonium citrate in a another from salt which reacts with the polassium ferricyanide to form Prussian blue. This reaction, of course, does not take place where the paper is covered and the unexposed surfaces remain white.

This same reaction can be used by the amateur chemist as the basis of a myatulving trick. A white sheet of paper is first prepared by immersing it in iron (ferrous) sulphate solution and a lowing it to dry. To all outward appearance it is still an ordinary piece of white paper. However, when the magician writes on it with a steel pen dipped into a solution of potassium ferricyanide, which tooks like water, the lines appear as a deep blue. This trick is often referred to as writing with water.

Priors of tracings and other similar opaque designs also can be made in tones of orange and brown instead of in blues and whites. In this case, the paper





is first immersed in copper sulphate soluion and dried. Then it is placed in a solution of potassiam dichromate and again abowed to dry

emposed to the 0.000

beautiful a pape

After exposure, the image is brought out or developed by immersing the sheet in a solution of silver nitrate. Silver nitrate is expensive, so economise by dissolving only a few crystals at a time. If desired the silver nitrate can be brushed on.

As the image develops, it will appear in brange tones instead of the usual blue. After developing, wash the print in water Be careful, however, as the image will have a tendency to fade if the washing process is unduly protonged.

ALTHOUGH the manufacture of photo-graphic film requires chemicals and skill beyond the means of the average home chemist, the experimenter can study the photochemical effects with silver compounds by preparing some salver chloride and exposing it to the light

Dissoive a few crystals of silver nirate in water and add some ordinary salt solution. Silver chioride will be formed as a curdy, white precipitate that will settie and turn to a blush-gray when the light strikes it

Sufficient silver ratrate for this experiment can be obtained by scraping the emulsion from several old photograph negatives and dissolving it in warm intric acid. The liquid obtained after filtering will contain silver nitrate and can be used in place of the pure solution.

By making use of these light-sensitive properties, you can make an attractive

copy of your lavorite photograph on the polished surface of a copper plate. Clean the sheet of copper thoroughly with emery cloth and then immerse it in a solution of copper (cupric) chlorale of moderate strength A coat. ing of white cuprous phlorine was be formed on the metal surface

After the copper sheet has dried, place the photographic negative over the sensitased conting and expose it to in are lepip for about one work e-If any ordinary lamp of high wattage is used a longer expo-

sure will be necessary. Best results will be obtained if several experiments are made with a small piece of copper to ascertake just the right length of exposure

Remove the negative in a darketed room and place the copper sheet in a bath of ordinary salt water. An artistic print of the negative wal appear. Allow the sheet to dry and then give it a thin coating of variush to prevent the metal from tarnishing. If desired, a abcet of brass can be used in place of the copper-

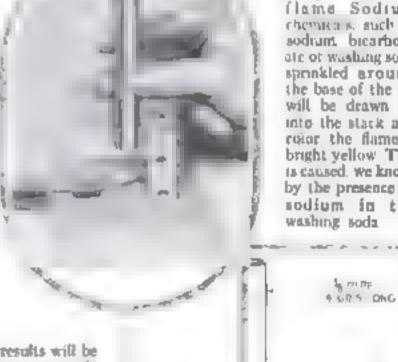
Many interesting experiments with light can be performed with the homemade gas burner shown in the illustrations, Besides

serving as apparatus for these experiments, the burner also will be a valuable addition to your regular aboratory equipment and you should therefore, make it.

THE stack of the burner is a short length of from pipe having an inside diameter of three-eighths inch. The gas jet is the spout of an old oil can bent to the shape shown. The washer, soldered in place just below the tip, serves as a scat for the bottom of the stack. The stack is supported by an adjustable clamp made from a piece of metal and fastened to the top of a small shelf bracket with a nut and bolt. A small block of wood forms the busine

To obtain the best flame, the opening between the justom of he stack and the jet should be altered so that just the right amount of air is drawn up and moved with the gan. Too much air wilrause the flame to roar while lack of air will give a wavy yellow flame. The best flame has two sharply defined blue cones and also it will neither roar nor wave.

> A burner of this type can be made to give an excelent monochrumatic (one color) flama Sodium chemicans, such as sodium bicarbonate of washing soda spankled around the base of the jet will be drawn up into the stack and color the flame a bright yellow This is caused. We know by the presence of sodium in the washing soda



SPOUT

MCSS

DILCAN

HOMEMADE BUNSEN BURNER All, the material preded to make a Bunsen burner is shown in the drawing. When ready ing use, it will look like the burner in photo

SO DEP ONE

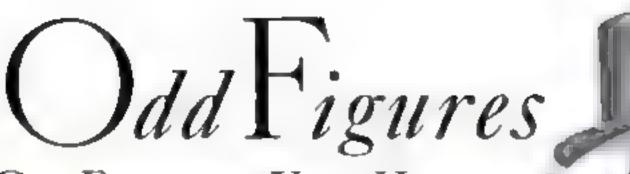
ARM OF CITY

WASHER

5. F & D

IN SPORT

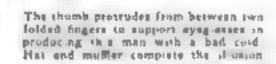
TOTAL

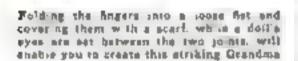


You Can Form with Your Hands



MUSING figures, grotesquely resembling human beings, may be made with the fingers and a few simple accessories such as a tuft of colton, eyes from a discarded doll and a streak or two of paint The six poses illustrated here were created by Otto Crov, German art st. With a bittle ingenuity, almost unlimited variaions may easily be devised.







Ashe of A even allwig



Black wool forms the hair and beads the eyes of this rather dour faced creation called a radical

With buttons for eyes and wool or colton combed out for a brard, you can bend your fingers so as to suggest that Santa Claus where pack is formed by the thumb and raised finger at left

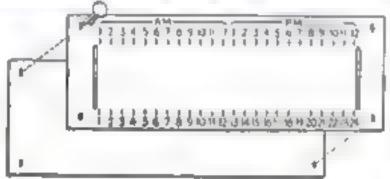
It is only necessary to put on the back of your hand lines suggesting a human lace, add stripes to the fingers to indicare the trunks to have the grotesque awimmor at the left

EASILY MADE CARDBOARD

Scale Is World Time Table



With this sea s the distance fan can convert time at any arction of the globe to social I ma Dangrum right shows how the acute to made



sary only to set the movable scale so the scheduled time for the broadcast of transfer of messages appears opposite the name of the country in which the station is located. The converted time then appears opposite the names of the other localities

for DX Fans

on the aliding scale. Since time differences exist only between points located on different mendans (there being a difference of one hour between every fifteen degrees) any two cities on the same north and south line will be on the same time.

The United States, for instance, is cut by four of the fifteen-degree divisions, giving Eastern, Central, Mountain, and Facilic Time. If it is desired to know the time in Baltimore Md., when it as 8 p.m. in London, set the scale so the word "England" appears opposite the 8 p.m. division on the large scale, Since Baltimore is an Eastern city, the converted time (3 p. m.) will appear opposite "East-em Time." With the same setting of the rule, it will be found that it is 2 p. m. in Chicago (Central Time), 1 p.m. la Denver (Mountain Time), and 12 noon in Los Angeles (Pacific Time).

It must be remembered, however, that the theoretical change of data in the world takes slace to the Pacific ocean just hast of the Hawn ian Islands. In other words, when it is 10,30 p.m. in Honolulu on May fifteenth, we find that the scale shows 4 p.m. in Indo-China. However, since the change of date takes place fust east of Hoselulu, it will be 4 p.m. the next day (May sixteenth in Indo-China Always read down when going from West to East, and up when going East to West.

Although the original scale was made relatively large for convenience, the ingenious reader will find be can make a converter on a smatter scale,

Making Coil Spring Binding Posts

HONOLYLU -

USCH AU

App. Cartin.

POPPORTOR OF THE

USPICTING:

OF MILES

DARTH OF

Statember Ad TOWNS

INDING posts made in the form of coil springs are great time savers for the radio experimenter who frequently changes connections. Pushing the spring to one side, opens the coils to receive one wire of several. When the spring returns, the cods grip the wires tightly

Any tightly coiled spring can be used or the amateur can make his own from brass spring wire. To wind the coil, fasten a large neal to a lathe, drill press, or hand drill chuck. Push the end of the wire into one of the spaces between the chuck jaws and turn the chuck by hand, winding the wire around the nail. Three-eighths or one-half mich lengths clipped from the coil form the binding posts.

To fasten the spring posts in place, bend a loop in one end of the wire that forms the coil, making it small enough to take a screw.--W B



Coil spring blading posts will save the experimester time when waring trial circuits

ing book and list of stations. It replaces complicated time tables and gives the converted time for any part of the globe. The converter, which resembles a slide rule, consists of two scales made from suff white cardboard or Bustol board

ISTANCE fant and short wave enthasiasts wal find the simple

time converter ibustrated above

a convenient companion to their

The small scale is movable and slides in sats placed at each end of the larger scale For stiffness, a third piece of cardboard can be fastened to the back of the large scale with brass paper fasteners.

The larger scale has two sets of twentyfour equally-spaced divisions, one set above and the other below the space occapted by the sliding scale. The upper divisions are numbered from one to twelve in two steps (1, 2, 3, 12, 1, 2, 3, 12) while the lower divisions are numbered from one to twentyfour consecutively. This lower scale represents Greenwich time

As shown, the sliding scale bears the names of the principal countries and sectrons of the globe arranged according to the spacing of the divisions on the large scare. If desired, the converter can be completed by adding the names of smaller entions in their proper locations.

To use the time slide rule, it is neces-

MANY Measurements

with ONE

Electric Meter

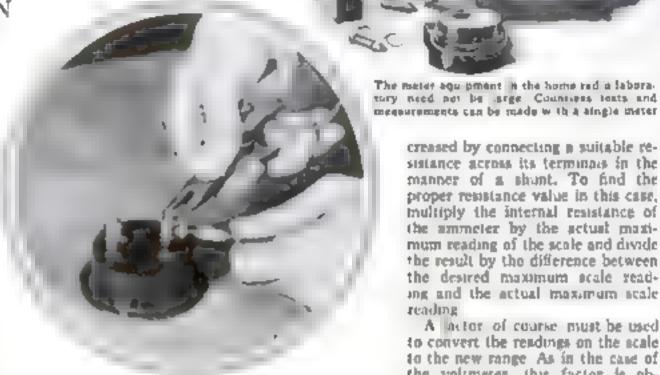
By JOHN CARR

HROUGH the use of resistances and shunts, you can increase the usefulness of your assortment of meters.

Almost every amateur experimenter and set bunder has at least a milhammeter. With this one instructions, you can make measurements of voitages as well as amperages. To change a milliammeter for voltages readings, it is necessary only to connect it in series with a suitable resistance. As an example a milliammeter with a 0 to 1 scale connected in series with a 1,000 ohm resistor will make voltage measurements from 0 to 1. If a 10,000 ohm resistor is connected in series with the meter, it will allow measurements from 0 to 10 volts and a 100,000 ohm resistor will increase the range to 0 to 100 volts.

In a similar way, the amateur can arrange his voltmeter so as to increase the limit of its scale. This is done by conneeting the major in series with a suitable resistor. To find the value of the resistance in ohms, divide the difference between the maximum scale reading desired and the actual maximum by the actual maximum and multiply the result by the resistance of the meter

Of course, with such a multiplier in series with a meter, it will be necessary



By connecting a resistance in series with a militam. meler you can use it over versus vertage fangels

to multiply the reading of the pointer on the scale by a conversion factor to obtain the actual voltage across the terminals. This factor will be equal to the new maximum reading divided by the original maximum reading of the scale.

For instance, if a resustance is being used to increase the actual maximum scale reading of 10 to a desired maximum readmg of 20 and the pointer rests at 8, the actual voltage will be \$ multiplied by 20 divided by 10 which is 16.

The range of an ammeter can be in-

creased by connecting a suitable resistance across its terminous in the manner of a shunt. To find the proper resistance value in this case, multiply the internal resistance of the ammeter by the actual maximum reading of the scale and divide the result by the difference between the desired maximum scale reading and the actual maximum scale reading

The meter ago pment is the home red a labora-

A lactor of course must be used to convert the readings on the scale to the new range. As in the case of the volumeter, this factor is obtained by dividing the new maximum scale reading by the actual maximum scare reading

Small alternating current readings also ran be made with direct current meters if a amail copper oxide rectifier, such as shown, is connected in shunt across the meter binding posts. Being especially designed to rectify meter current, the device measures less than one inch square and can be connected permanently in a confined space. With one of these rectifiers accurate A. C. measurements can be

A voltmeter also can be used for making fairly accurate measurements of resistances. The unknown resistance is connected in scries with a known resistance and to a battery. Voltmeter readings are then made across each resistance. The value of the unknown resistance will be equal to the value of the known resistance in ohms multiplied by the reading of the voltmeter when it was connected across the unknown resistance divided by the voltmeter reading when it was con-

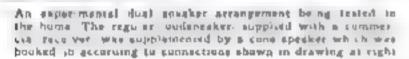


the terminals of an ammeter

will increase its scale range

New to wire resistances to increase range

Second Speaker Adds Tones



to your RADIO SPIDO CONDENSED VADIABLE

PLATE PROND

PHARLAD DYNAMIC SPEAKER IN HE IT STY ANTR

Dagram altows bow a code speaker can be connected up to supplement dynamic speaker

LTHOUGH modern radio design presents hothing that is startlingly new, there is one development of special interest to the radio experimenter and set builder

A few years ago, the dynamic loudspeaker replaced the order cone type because it was capable of handling greater power and a wider range of frequencies with increased fidelity. Now dual speakers and single speakers of a refined design are being used to take care of even greater power and extend the reproduction range.

The title, "dual speakers," however, is used at present to identify either of two distinctly different systems. In one, two speakers, similar in construction but having slightly different peaks, are connected in paradel to the output transformer of the receiver. These speakers operate more or less as one to give a fullness, roundness, and perspective of tone that would be difficult to obtain with a single unit of ordinary design

In the second system, two speakers also are used, but each unit is designed and connected to cover a separate portion of the entire frequency range. One speaker reproduces the high frequencies while the other brings out the lows.

With extended range dual speaker arrangements, the requirements placed on each unit are reduced and the two speak-

ers can operate with relatively distortionless fidelity from the low bass notes of the bassoon to the high-pitched shrills of

To the amateur set builder extended range loudspeaker equipment opens an interesting field of experimentation.

The particular extended range system shown at A in the drawings was designed by the Bell Telephone Laboratories and was used in connection with a special high frequency speaker developed to operate on frequencies from 3.000 to 12.000 cycles. A second speaker to cover the range up to approximately 3 000 cycles was connected to the low-frequency side of the careto ly designed filter arrangement

Each filter delivered to each speaker only those frequencies that corresponded to its range. When operating, each speak-

er reproduced the tones in its range independent of the other,

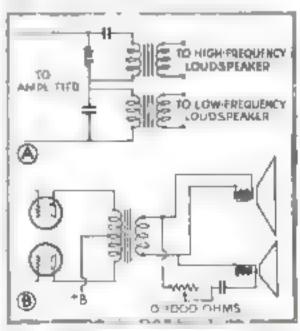
There are, however, two simpler systems that are well within the range of the amateur's skill and his supply of equipment. These are shown in drawings B, below, and C in the second column.

The fact that most old speakers of the cone type are particularly good on the high frequencies forms the basis of the connections shown in C. Almost every amateur has a cone speaker lying around and he can put it to good use accentuating the higher tones that may be lacking in his loudspeaker

The arrangement shown can be used without aftering any of the connections to the loudspeaker that is already installed Two wires are connected to the plate prongs of the two output tubes and these lead to the cone speaker terminals which are connected in series with a 0 to 20,000 ohm variable resistor and a fixed condenier. The capacity of the condenser may be anything from one-tenth to one microfarad Try several, and use the one that gives the best results.

If two dynamic speakers are gygilable, one being designed for high frequency reproduction, the system shown in B can be used. The high-frequency speaker is connected in parallel with the regular speaker and a variable resistor and a fixed condenser, having a capacity that may range from one to ten microfarads depending on conditions, is inserted into one of the leads. To simplify the drawines, the 110 volt power connections for the field are not shown

Both of these systems depend on the filtering ability of a condenser. A condenser, as we know, tends to pass the higher frequencies more easily than it dies the lower ones.



Upper diagram shows how to operate low and high frequency speakers. The other shows how dynamic speaker is hooked into set

"Something wrong?" Our
W non maked on he
walked toward Chet Harmon's car "I'l say something's wrong Harmon
grambled "The carburetor's on the blink again
This blamed car won's
even pull over an apt
heal without gronning"





Longer Life for Car Valves

BY MARTIN BUNN

the HARMON chased his car the the Model Garage. Sputtering and coughing, it gave one tast asthmatic wheese as it reached the center of the repair shop

"Something wrong, Chet?" Gus Wil-

son granned.

I'll say something's wrong," Harmon grumbled, "The carburetor's on the blink ogain. This beame car's getting worse and worse. Won't even pull over an ant hill now without grouning

Gus lifted the motor bood. "Why pick on the carburetor?" he inquired after a brief inspection, "Maybe it's something clse this time. Start her up and let's hear

her "

After several vam attempts, the motor half-heartedly consented to run. When Gus ferked at the throttle rod, it sneezed violently and, with a final gasp, died

"Acts like a bad case of worn valves."
Gus said half to himself "No power and

no compression."

"Worn valves, my eye?" anorted Harmon, "The valves are O. K. I just reground and adjusted them. Guess again, Con."

"Well, seeing's believing." Gus chuckled good-naturedry "so let a take off the head and have a look. Tell you what I'll do. If it isn't the valves, the job won't cost you a nickel. How's that

"Suits me," spreed Harmon, "But I still think it's the carburetor"

Gus opened the drain cock on the radiator and then proceeded to loosen the upper hose connection on the motor

"Take a look for yourself" he bade. lifting out the motor head, "If those valves aren't burned and pitted. I've never been in a garage. They look more like hexagonal bolt heads than valves. How long ago did you grind them?"

Not more than a month," Harmon replied. "I did a good job too."

Gus muffled a chuckle "Maybe you did too good a Job, Chet. Too much grinding is worse than none at all Were they in had shape when you started?"

"I'll say they were. All burned and

pitted."

"When a valve gets that bad you might better throw it out." put in Gus, lifting one of the exhaust valves from place. "You ground this one so long there's a ridge all the way around it. A valve in that condition wan't last long, Another thing, never grind a valve to a feather edge. The thin metal on the outside won't stand up two bours in a modern high compression motor."

GUS says:

When you're tempted to cuss and growl because the headlights on another car blind you, remember that your own lights probably aren't much better. Night driving is a serious business and requires good lights, good judgment, and good eyesight. Don't strain your eyes by trying to see with faint, poorly adjusted lights. To be safe, have them tested often.

"I thought they made valves out of tough stuff" Harmon objected, "They shouldn't fall to pieces like that"

Die you ever singe the back of your hand on the exhaust maniford?" Gus asked, "Well, it get's pretty hot. Around 1.400 degrees, even in cold weather, Being right in the cylinder, the valves get about two hundred degrees hot er than that The heat glone wouldn't be so bac, but they've got to bob up and down thousands of times a minute into the bar-

But the intake valves aren't as badly burned as the exhaust valves," argued Chet

"Of course they aren't," agreed Gus "Why should they be? The hot gases burn the exhaust valves after every explosion. That a why some car manufacturers put a better grade of steel in the exhaust valves."

Don't the valve seats burn and warp

too4" Harmon asked

"Sure, but not like the valve heads." Gus replied, pointing to the open valve scal in the motor block "A valve seat has a lot of metal around it and it's couled some by the water jacket. The valves though haven't much surface to carry off the heat and they're only cooled by the stems and their contact with the volve seats when they close. That a why a valve that doesn't seat properly is bound to burn and warp."

"I never realized that valves took such a beating," confessed Chet, "No wonder

they don't last long"
"They will last long" Gus corrected him, "if they're (Continued on page 103)

BETTER SHOP METHODS: IDEAS FOR THE HANDY MAN: BLUEPRINTS



MODEL MAKING : HOME WORKSHOP CHEMISTRY: THE SHIPSHAPE HOME



THIS NEW Outboard Speedster

WILL WIN RACES FOR YOU

strength, combined with safety on the turns reac speed and unusual rough water qualties, are the disinguishing fea ures of this trim, jounty

lettle outboard speeds er Scram It uses the small but very popular class. A ou board motors or class "B motors.

It was designed especially to utilize the power of these motors as efficiently as possible. The original bul shown at the righ has seen (we very successful racing seasons. In nine races it won six firsts two seconds and a third. Several improvements were then made in the design to adapt it to the new and faster motors, and a new had was built. This is the one shown in all the other illustrations. It promises to give a good account of

MIMPLICITY of construction and itself in fast company this season. The new had has been severely tested on both smooth and extremely tough waver and shows no signs of weakening. Sharp jurns have been made with a pepped class

This is the original Scram with H S. Beverage, designer and builder, at the wheel In nine races it won aix firsts, two seconds, and one third

B motor cunting wide open and there was no indication of tripping

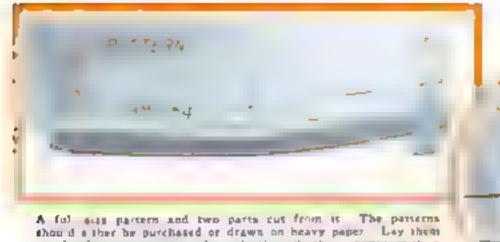
Arthough designed for class "A" and "B motors. Scram will perform excellently with "C" motors, if the material

> sizes are increased so as to bring the weight up to requi rements

The improved Scram weights complete with fin, steering gear, and other esservial frangs, 114 b. The over-all length is 10 ft 4 in and the over-all beam 4615 in. This boat was built with spruce frames and mahogany planking. The mini-mum weigh, for this class of he is is 100 in The cost of construction should not exceed \$35, including the steering wheel and other purchased parts, although the cost will vary somewhat in different local ries. The drawings appear on pages 60 and 61 the materials on 86.

How to Build an Inexpensive Little Boat

TEMPLATE



A full sain partern and two parts cut from it. The parterns should a ther be purchased or drawn on heavy paper. Ley them on the frame mater at and prick through the out act with a mark og when an shown below. Then saw out and place the parts

To begin the construction it will best be necessary to construct the form upon which the hull is built. This is sawn out of a 2 by 10 in, by 10 ft. plank. The drawings and photos give complete details. When this is finished, it is mounted on wooden legs like a sawhorse

Fall size patterns of the frames should next be drawn upon heavy paper, unless here are purchased all ready drawn which saves a great deal of time. Lay here patterns on the frame material so there are no weinkles on the paper, then prick through the outline of the frame with a marking wheel

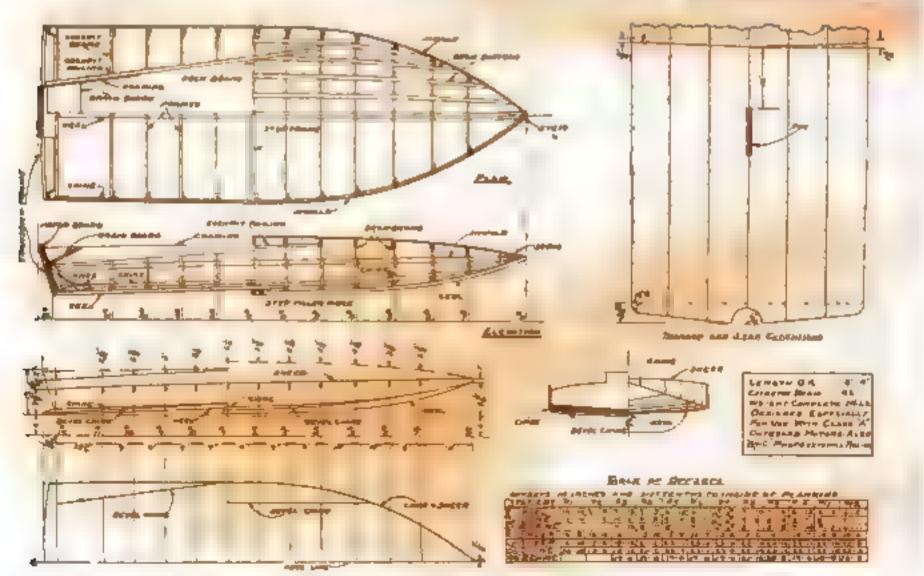
When the sides and bottom members of the frames have been sawn out and the edges planed evenly, lay the members upon the paper pat erns so as to conform to the out me and fas en hem together an indicated, with two 1½-in, copper rivers. Dr.d. by its lead holes for the rivers before fassening the two parts, and

Leying out the full race patterns is made easier by value a template as shown below. The step frame is con-

The step frame is constructed as shown in the drawings. Note also the details on page 86. The adjoining surfaces are coated with casein glue and fastened with eight 139-in. No. 2 screws in the bottom member and two 134+ in. No. 8 screws to each side member. All screws are flathead unless otherwise specified and must, of course be brass or galvanued from The transom frame and motor board are next coated with casein glue and secured to the transom with 11/2-in. No. 8 acrewa.

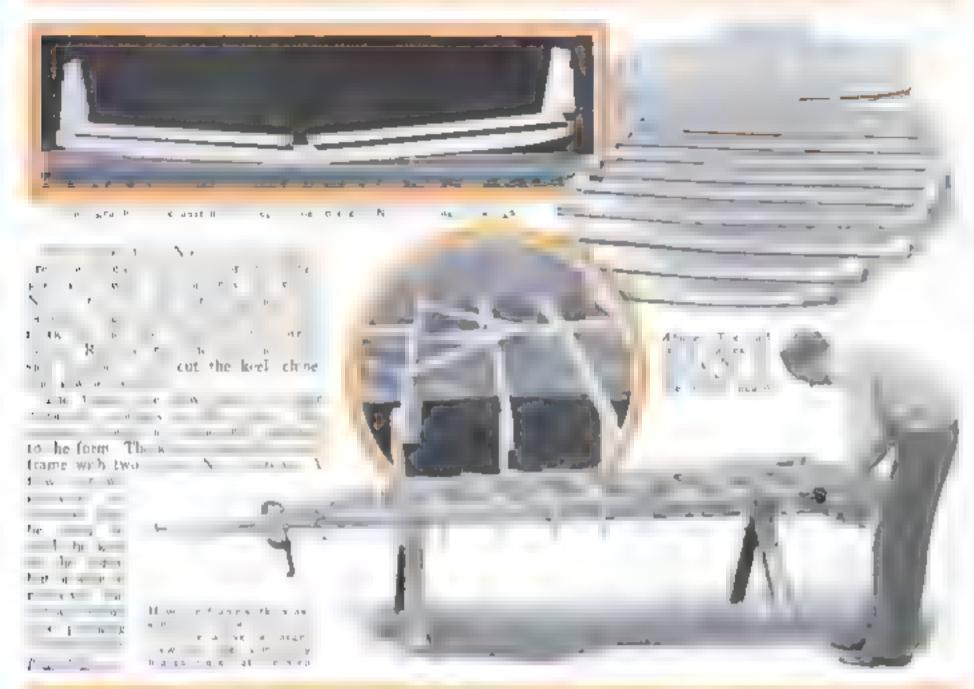


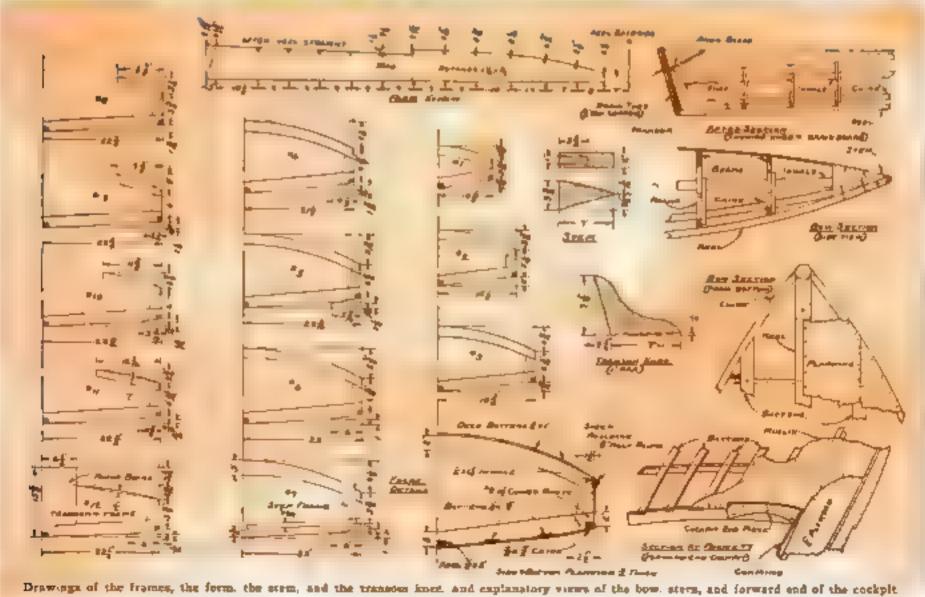
frames are set in somewhat so that the ore held tags has with cases glue and r vets



The assembly views, a bottom view of the transcen and step extension, and a table of offsets for those who prefer to work from the figures

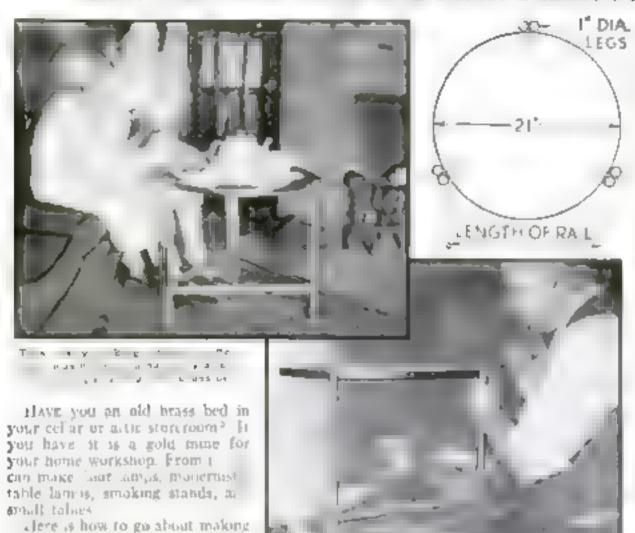
Designed for Class "A" and "B" Motors





MAY, 1933

Tubes from Old Brass Bed Make Frame for Fine Coffee Table



In assembling, the acress are inserted at a slight angle. Above: Layout for finding length of races

for the table top. I used the top of a discarded school desk. The top could be made from a couple of old extension table leaves glued together, but anything you can get that will give a round top about 21 in, in diameter will do.

The legs were made from six tubes taken from the bead of the bed, cut to a length of 18 in. The rails, which are set 4 th. up from the bottom of the legs, were made from three tubes taken from the foot of the bed. Their length was found by making the layout shown in the accompanying diagram. This was drawn full size on a sheet of wrapping paper, Holes had to be drifted and acrews inserted at a slight angle in order to get them through the side of the tube that touched the table top. The method of assembly is itlustrated at the left. The rank were fastened to the lega with the fastenings used originally on the bed itself, these were merely reset on the shortened rails.

After the table had been satisfactorily assembled, it was taken apart and the brais tubes were buffed and given a coat of clear lacquer. The top was sanded, stained walnut, and French polished, that is given a padded shellar finish. Then the pieces were reassembled and wood buttons were turned, polished, and driven into the tops of the legs. The inside of each leg at the bottom was soldered for solidity, and the table was then ready for use. The whole job was completed in one Saturday afternoon.—E. C. Wittiek.

A PUZZLE SHIFTER

a cof ce table but the one shown

First get your bed. Some togen

taty wal have to be exercised as taking it to pieces, but that in port

of the fun. Then get the board

To the real picture puzzle fun, the smaller and more irregular be neves the more a working is the task of assembling them. The writer has found that It he ps to use a puzzle shifter I ke that shown at the right. The small cuplike rubber tip, when

Using a tiny suction disk to shift parts of a picture puzzin

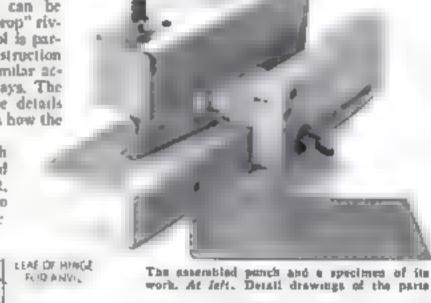
allows it to be moved, turned, slipped in and out of spaces in which it may fit closely, and all with little danger of disturbing the assembled parts of the puzzle. The spring allows the holder to be held and worked at a convenient angle.

To make such a tool, obtain an old tire valve core spring and a small metal capped gasket out of a tire valve cap. The latter may be readily pushed out with a small nail, Punch a hole through the metal top of the gasket, place one end of the core spring over it, and expand the metal top until the spring is lightly held. This can be done with the point of an ice pick. It is better, however, to use soider to join the two parts securely. Force the other end of the spring over the point of a lead pencil or better yet, a small pointed dowel stick.—Frank W. Bentley, Jr.

PUNCH FOR FORMING DUMMY RIVETS

With the aid of this punch, miniature girders, tanks, and other metal parts of models can be quickly embossed with "prop" rivet and boltheads. The tool is particularly useful in the construction of bridges, towers, and samilar accessories for model railways. The drawings below gives the details and the photograph shows how the parts are assembled.

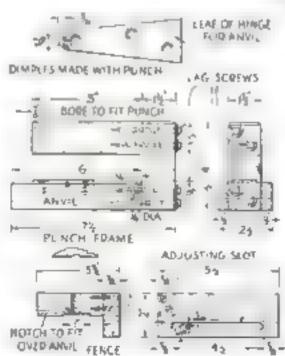
Make a price punch with a slightly rounded point from an old nail set, fitting it with a spring to raise it after the stroke



Insert it in the guide hole to locate the die socket position in the hinge leaf that is used for an anvil, Remove the latter, rest it on a firm base, and punch the dample to a full 1/16-in, diameter Make a second dample as shown, at a distance equal to the desired spacing

To use the punch, adjust the fence, lay a strip of tin or other than sheet metal face downward, and strike the punch with a light hammer. Move the strip until the embossed rivet fits into the second dimple, and punch again. This gages the spacing.

Cardboard and celluloid can also be embossed with this tool for gluing or cementing over wooden forms. After being pointed, they are almost as realistic as if made of metal—EDWIN M. LOVE



SIMPLE SLIPKNOTS FORM THESE

Indian Wampum Belts



By Kenneth Murray

ECORATIVE beaded effects like those to be seen on skilifully woven lindian wampum belts can be imitated with simple slipknots. Selfs that are knotted together in this manner are very durable. The one illustrated was made with size to sike cord in blue and silver gray as a gift for a woman. For a man, belts of this type should be made with heavy wax-finish cord

To make a 34-in, belt cut four strands of gray 25 ft, long and one of blue 48 ft long. These are doubled and looped directly on the buckte as shown in Fig. 2. at the left, Start tying as illustrated in the series of views on page 90. Use the left-hand cord as a hiler, and over it tie , wo of the shaknots with each of the next four cords. How to the these knots is shown very plainly in the first photograph in that series (Fig. 7). Draw the knots up light to give a head effect as shown in the see and photograph of Fig. 7 (the top one at the right), Use the right-hand cord as a filler and add two knots with each of he following four cords. The filter cords will then be in the center Add two knots over the one coming from the right with he one from the left on shown in the hard photograph of Fig. 7

It is now necessary only to repeat this method of knotting, row after row, until the blue cords automatically arrive at the outsides as shown in the fourth photograph of Fig. 7 and also in the center view of Fig. 2. They are then knotted twice over each of the four adjoining cords, which returns the blue to the center (afth and sixth views of Fig. 7 and Fig. 2, at right). This (Continued on page 9)

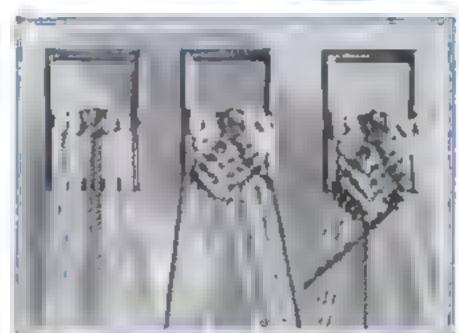


Fig. 1 The completed belt and, at the right below, a wiew of the bushie end alightly larger than full size

The buck e is I in wide, and the colors are blue and gray

Pig 3. The best is ended with the best cords on the center for 3 in House are unnexcentery as the buckler tongue can be pushed through the belt against

Fig. 4. These siterate we designed are alone to single whitecords to as a unit nurse for Any parents of the site o



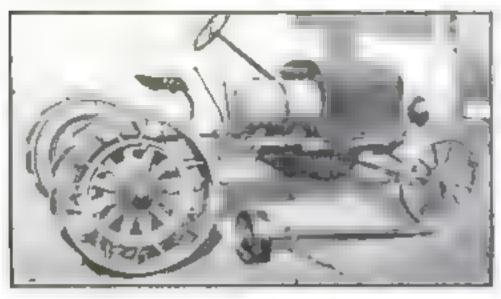
The cords looped on the buck a the dispit had of the dismand design, and how the pup cords or returned to the center

Fig 5 For convenience, the the tong cords and hatks a a poin several test from the harring



Fig. 6. The work is kept in order with a rules, a small C-clamp, and two push plan

Farm Tractor and Power Plant Assembled from Old Auto Parts



This piece of farm machinery won second prise in ou recent Auto Engine Contest. It cost \$17.50, but the hulder of 6 h a total machine work and we ding



to the base of the teeth. A bushing was turned to a shrink fit over the pinion as shown at C. We used a pulley of 12 in, dameter with 4 in face. The tube was put in the larke anathout 1, in out off the end I, was then threaded on the inside and a nut made to screw in against the outer ring of the ball bearing.

Removing three balts from the rear universal allows the short drive shalt to be pulsed out and the pulsey shaft pushed into place—J C Miller

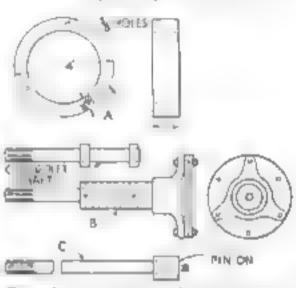
Titls combination tractor and belt power plant was made from a Ford engine with frame and front wheels a 1925 Chevrolet gear shift an International Modelsh truck rear end, and two bishort wheels. The rank was shortened in the sawing cith sale in two 23 in true the rear end and lapping and criticing for two 33-in, bolts. The rear end was set on two 2 by 5 in, steel posts with U-bolts ground frame and axies

The front shaft of the gear shift was removed and machined to fit into the rear end of the Ford engine. The rear half of a universal housing was obtained from another gear shift and the holes filed a little to fit the engine. A steel collar was turned as at A to form a spacer between gear shift and engine. Three 1% by

in, study were made, holes were drilled and the gear shift was bolted to the engine. A piece of 1/3-in, angle from was bolted on the frame above as an additional support; and two ½-in, bolts with short pieces of 1/3-in, pipe for spacers over the bolts make it very rigid.

The tractor drive was made by sawing off the 2-in tube drive shaft to rear end (some of this waste made the two posts previously mentioned) and using an old Chevrolet shaft that had a good front end. Two rings were turned to take care of the difference in diameter and drailed through for two 5 to-in, bulgs as at B

The pulley shaft was made from a complete Chevrolet transmusion shaft. The pinion was removed and anneated then replaced on the shaft and turned off.



These diagrams plustrate the principal work it was agrees y to do nother machine about

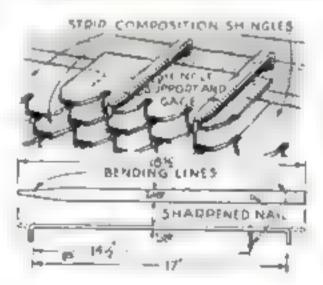
SPEEDY WAY TO NAIL STRIP SHINGLES

IN LAVING strip composition shingles on a roof a pair of from made as shown at the left will save much time. They keep the strip in place and allow both hands to be used for nailing, whereas when the shingle is held with one hand and the nailing done with the other there is always danger that it will slip. When sufficient hads have been driven, the from are removed and placed in the slots of the shingles ready for holding the next strip.—P. K. Zebbe



SAFEGUARDING POCKETS OF WORK CLOTHES

Most mechanics have at times lost money or other articles of value from the pockets of their overails or the trousers of their working clothes. This can be prevented by closing at least one of the pockets with a hookless or appear type fastener. In the writer's case, a fastener salvaged from a discarded work shirt was cut off and sewed in place.—A. V



OLD GARDEN HOSE GIVES CHILDREN FUN

A darbest hose that no longer holds water makes excellent rovers for trapeze hats and other equipment used in a chir-

deen's playground. The device shown consists of a rope summing through an old piece of hose and secured at a there are to



The rope is incased in a length of discarded garden hose and tied at each and so a tree limb so as to give it considerable apring

a tree limb. The limb should be small enough to give considerable spring. If trees are not available, a spring may he cut in the line A rope at one end is used by the smaller chadren to pull the hose down so they can read at This device looks thinterestingly simple, but children will play at it vigorous ly -D. A. BUTLER.

An easily built model of

Capt. Mollison's

famous transatlantic

MONOPLANE

A MODEL of The Heart's Content, the favorite plane of Capt. J. A. Mollison, England's famous long distance fiyer, makes an interesting addition to any model builder's group of planes. It was in this little plane that he recently flew from England to Brazil, crossing the South Atlantic in one hop of 1,885 miles.

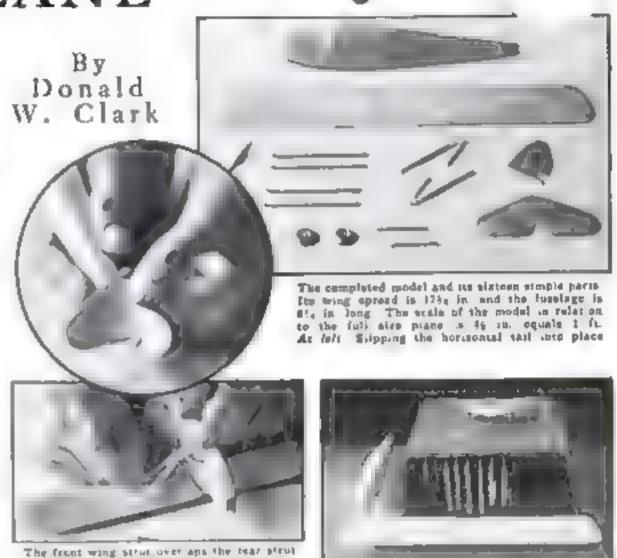
The fuscinge is whittled from soft pine. Only one tail slot is needed. Make two notches, as shown, to take the upper ends of the struts marked A. Four J.-in lengths of 1/16 in, diameter wire, set into holes, will serve as exhaust paper.

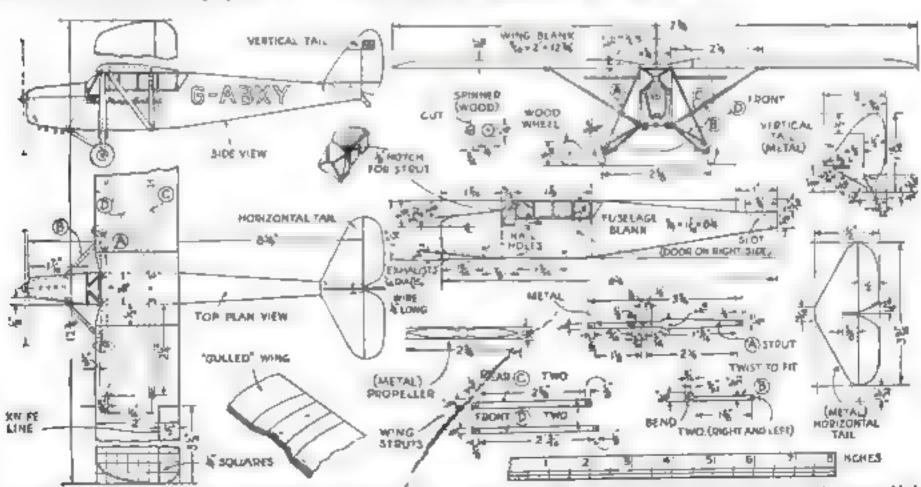
Cut out the wing, shape to an air-foil section with a small plane, and cut out where it is to be "gulled"

Make the tail units, propeller, and all struts of thin aluminum. Struts B need to be twisted slightly so they will fit sout against struts A, where they are fastened with tiny aluminum rivets. Short lengths of pins can be used to hold the struts to he wooden parts.

The wheels are made of wood, rounded and sanded. Pine will do for the axles.

The model illustrated was given two coats of cream color paint and afterwards trimmed with black. Dark brown could be used instead of black, but make the tires black, also the name and number if these are added, Polish the propeder.





at buttom. Right Drying the painted parts

Assembly drawings of the model and details of all the parts. The shaping of the wing where it is "gulled" can be done with a rasor blade of a sharp haife, not the slopes first and remove the suidile portion alterward. The one tail slot can be out with a fine back-new blade

Concrete Stepping Stones Cast in Flexible Metal Forms

Probably the most attistic and practical path for the laws or garden is one that is made of stepping stones. When hid out in a natural manner, such a path will harmonize perfectly with any plan of landscaping, whether formal or informa-Contraction and expansion cannot effecit, and no subsequent attention is required except occasionally to mow the grass which grows between the stones

The material used in constructing such a path may be either natural stone or molded concrete stone. In most localities natural stones of a suitable suc and thickness are both expensive and difficult

to obtain. Concrete stepping stones, however, when cast directly in place by the following method of using flexible forms, can be laid easily and economically and can scarcely be distinguished from the natural stones. By using the same forms, stones of various sizes and shapes can be cast

quickly and permanently

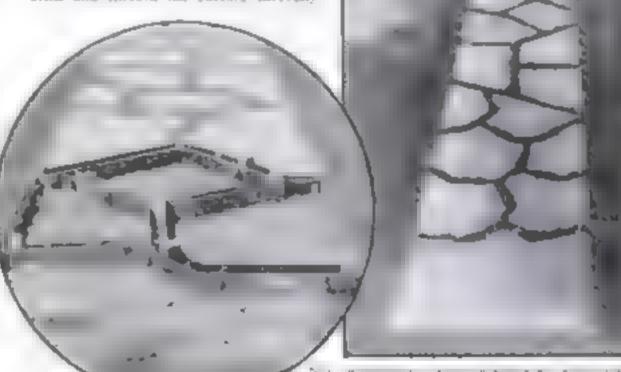
Lay out the path to the desired width and contour, and remove the ground to a depth of 2 or 3 in. A thin layer of sand or gravel should he put in the bottom to assut in keeping the forms in place. The side strips and flexible forms are next arranged as desired. These consist of strips of any light gage sheet metal 2 or 3 in, wide and of various lengths of from 1 to 3 ft. The atres may be cut from old scraps of sheet metal found around every garage or junk yard, and inasmuch as rust dents, and other imperfections are not in the least detrimental, they

may generally be obtained for the asking. No great supply of these streps is required because after the concrete has remained in the forms for about an hour they can be removed and used over again.

be forms so that the stones when cast, will be about he in, above the ground level. This will insure adequate dramage in wel weather and still be low enough so that the lawn mower can pass over the wask easily. To keep the forms properly spaced, theert small wooden blocks 1 - or 2 in wide wherever needed.

part of cement to

5 parts of course and 1f dry sand is
used the corres of of water for the
mix are is 5, gal, for each sack of
cement used. Place the mixture in the
forms and smooth the surface carefully



with a trowel or float. If desired, the walk can be slightly crowned so that water will run off more readily.

Concrete should never be permitted to dry out rapidly. As soon as the mixture has set, it should be covered with old sacks, pieces of burlap, or the like, and these should be kept moutened for several days. Fill the spaces with soil and plant grass seed.—L. C. Pautier.

BALLOON SCARES BIRDS FROM GARDEN



To recenter birds away from a berry patch or a newly planted lawn, where they often do considerable damage in a short time, home gardeners sometimes the a slightly inflated paper sack to a stick. When it becomes damp, however, the bag is useless, and the string is always getting fouled on the stick. A more efficient and lasting device is shown at the left.

Get a small red toy balloon, inflate it moderately tie it, and leave the string 4 or 5 in long. Then drive a stick into the ground and nail on top of it the tin cap of a small preserve bottle or can, letting the head of the nail project slightly: Bend the end of a short piece of stovepipe wire loosely around the nail, and bend another eye in the other end slightly beyond the edge of the tin. Tie the balloon string to the outer eye. As the breeze blows the balloon about, the wire slips arouled on the tip, and the string cannot catche. It will be found that even rain will not affect the balloon, which will stay inflated for days.-F. B.

Birds can be hept from a new'ly planted sawn or garden patch by tyring a small toy be took to a stake in such a way that it will bob around and around in the breeze



ELASTIC IN WIRE FENCE PREVENTS TRIPPING

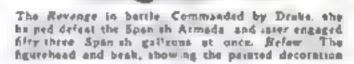
TRIPPING over low wire fences around flower beds or newly planted grass plots may be prevented by the method klustrated above. A heavy elastic band cut from a discarded inner tube is inserted in the fence by cutting the wire and tying the two ends to the rubber band. The elastic must be strong enough to keep the wire taut. When a person walks into it unknowingly, the wire will give sufficiently so that he will be able to catch homself.—Leonard Meteriell.

Finishing the Hull of Our New Model



By Captain

E. Armitage McCann





The high stern. Note the highly decurative lanters and the projecting stern milety, which is black on the outside and ornamented to the gay pa sted shields and the roys cophec

The wasst of the ship looking forward. This above the fin shed appearance of the guns, hatches, and overlay g. On he outside all the handrails are painted white with diagonal rad arriges.

ANY thousands of Popular Science Monthly readers make a hobby of building ship models. They contains year after year, Some of them have constructed every one of our long series of models. Why do they do it?

If you have built models, you will know the answer, but if you have never tried this most satisfying form of craft work, why not begin making a model and find out for yourself? You could not start with a better model than oue new one of the Elizabethan galloon Revenge. This is a particularly colorial and picturesque model, yet it is simple to construct, does not require any previous knowledge of ships or model making, and calls for no unusual accuracy or mechanical skill.

The model is fust the right size for use as an ornament in the average small home. What will appeal to almost everyone, too, is the fact that some of the most throlling stories of the sea are connected with the Revenge. The memory of her gallant battles have come down to us through 350 years.

They were great fighters, these (Continued on page 89)

PEDAL OPERATES FOOLPROOF GRINDER SHIELD

This foolproof grinder shield, an invention of the writers, has proved satisfactory during months of constant use by different mechanics, and has been praised by safety and insurance officials. When the operator steps on the pedal, the transparent shield pavots forward over the grinder wheels and in front of the workers face. At the same time, a switch hidden in the base of the motor and connected by means of a fiber tube or rod to the shield supports is thrown on.

The advantages of the shield are: It protects the operators eyes and face, it is clean and sanitary, the grinder cannot

SHEET CEP OF DE CONTROL ON SHEET CEP OF DE CONTR

Occurs arrangement of the posts operated shield and switch. The directions must be adapted to suit the goodst being used

3-DE VIEW

be used without the shield, the operator cannot leave the grinder with the power on, and there is a psychological advantage in that the shield, by prvoting back and forth, keeps the operator constantly aware of it. Therefore it is not abused or damaged

Since grinders vary greatly in their size and shape and in their mountings, pedestals, and other details. I have omitted many of the measurements for this particular assembly Incidentally, the pedestal illustrated is one that is easily and cheaply made up and is excellent for drike vises, and the like, as well as for a

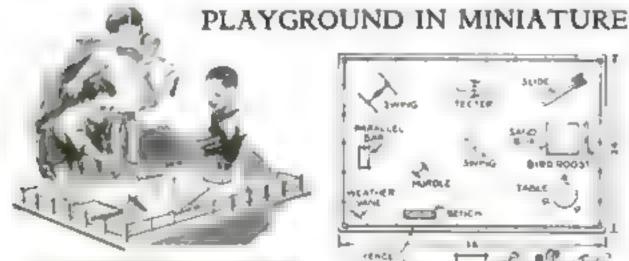
grinder The principal requirement is that the shield proper extend forward and to the sides far enough to shield the operators face completely and to have it far enough above the wheels for clearance

In this instance, the togele switch that came mounted on the front of the base was removed, an extension was added to the togele and it was then fastened inside the base as shown on the drawing. The pins in the fister rod are set far enough apart to compensate for the differ-



What the redal is presend, the shald aw ign forward and the mutof starts

ence in the radii of the toggle arm and the shield support. An advantage in using sheet celluloid for the shield instead of glass, ande from the fact it does not break, in that it is not cut by the flying fragments as is glass, which soon becomes bratter—liveen Taylors

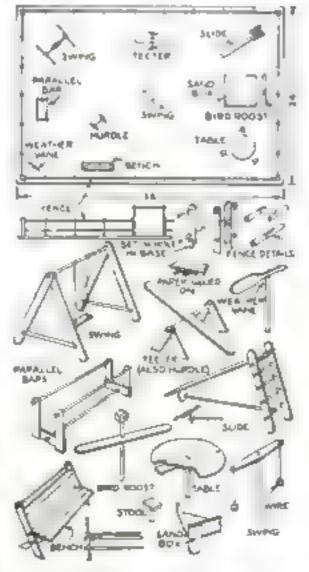


Dot! houses and farmyards are old favoriess, but here is something new-a top playground

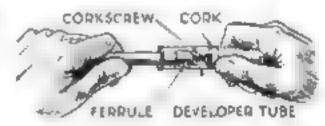
MINIATURE toys, such as the realistic little playground illustrated above, have a strong appeal for the younger children particularly if they can shift around the various objects to suit themselves and really play with them.

really play with them.

The playground apparatus, table bench stools, weather vane, and tand-box can be made easily from scraps of cardboard, lollypop sticks or similar round sticks and a few thin, flat sticks of the type used as handles for various ice-cold confections sold to children. A supply of these a little glue, some string, and a piece of 2 by 3 ft. fiber wall board for the base are the only materials required and for tools it is sufficient to have a razer biade, pocketknife, small hand drill ruler and pencil Paint the apparatus with quick drying enamel or other glossy finish.—D. W. C.



Plan view giving a suggested layout of the playground and drawings of the equipment



LONG CORKSCREW OPENS DEVELOPER TUBES

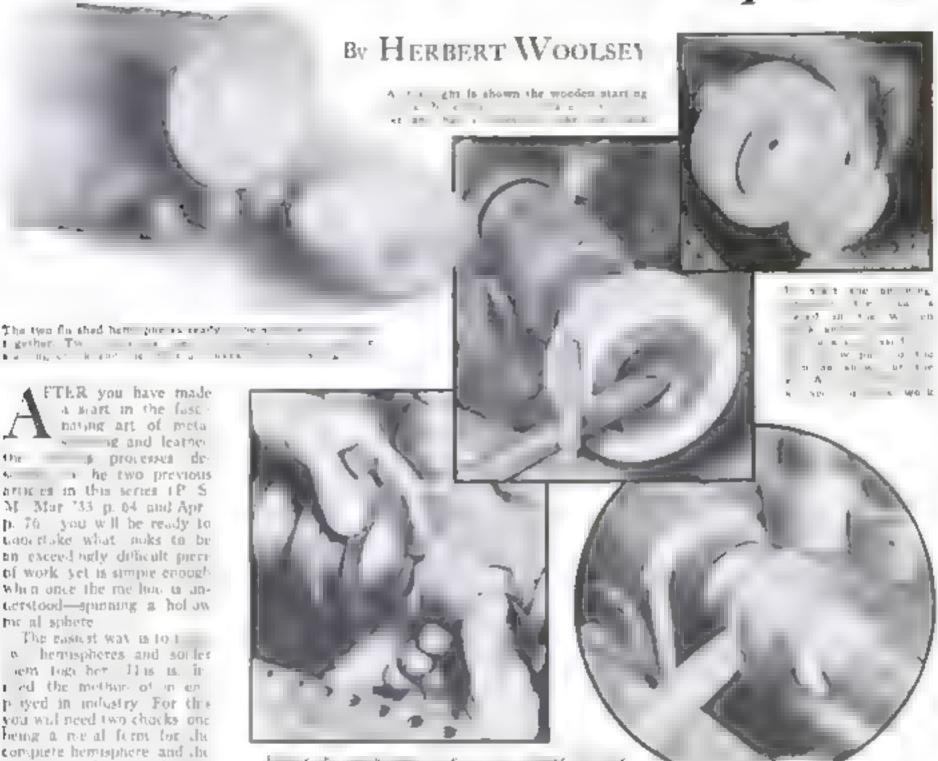
Grass tubes containing photographic developers often have a second cork half-way down to separate one chemical from another. An ordinary corkscrew either will not reach the cork or is too coarse

to use with so deheate a cork and therefore merely breaks the cork. The corkscrew illustrated however, is long enough to reach to the bottom of any developer tube on the market and at the same time is fine enough to pull the cork without breaking either it or the tube

This corkscrew is made from a 6-in length of 1/4-in wooden dowel rod, a fermile, and a small corkscrew similar to that

supplied with many varieties of mouthwash bottles. Cut the ring from the small corkscrew and solder the twisted wire to the threaded part of a wood screw from which the head has been removed. Drive the ferrule onto the end of the dowel, drill a small pilot hole, and screw in the wood-screw end of the corkscrew. A cost of shellar will protect the handle from the developers.—Ronald L. Ives.

How to SPIN a Hollow Metal Sphere



other a wood or metal start. er with a concave depression in the center that corresponds

to a slice from the surface of the finished sphere. There is a rim around the starter chuck to hold the disk in place while it is being spin. If an attempt were made to gtart the cisk directly against the final hemispherical form, it would touch only at a point, and there would not be sufficient drag to turn it

After the starter chuck has been made, place the disk in it and, with a roundnosed tool, spin the center into the depression. The work at this point will look somewhat like a wide-brammed hat or trench helmet. Spin the other half of the sphere to the same degree, and then replace the starter chuck with the second or finishing form

Reverse the blank so that the hollow part will fit over the nose of the chuck. Next place over this a wood adapter or "follower" that has been turned previously so that the part resting against the disk is concave. Run the back center against this adapter, and spin the remainder of the beausphere. Try to avoid making a ridge where the first stage of spianing stopped.

tellishing admired at the the time back have no absorbly a legitle

After the bemispheres are trimmed and smoothed, solder them together to form a perfect sphere, and buil the surface until the seam does not show

In doing many other stunning jobs, you will find it necessary to start the work m a concave chuck so that subsequent spinning can be performed in the usual manner with the blank held firmly against the form by a wood back-center adapter

There is one simple job of spinning that the owner of tools will find useful. This is the spanning of metal collars or ferrules about the handles of clusels. screw drivers, wood turning tools, knives.

and other tools. Place the handle in a chack with the end which is to take the tool projecting. A three-jawed chuck can be employed if provisions are made to prevent scratching the wood. Cut a disk boving a radius sligh ly greater than the desired collar and place it against the handle, holding it with a back-center button. Then spin the disk down and around the handle, forming a collar, It will be forced so tightly against the wood that it never will come off, particularly if a groove or two is formed with a sharpnosed tool. Finally, drift a hole to receive the shank of the tool that is to be set into the handle

This is the third of a series of articles on metal spinning. The fourth, on spinning with sectional chucks, will appear in an early issue

New PLANS for a Beautiful

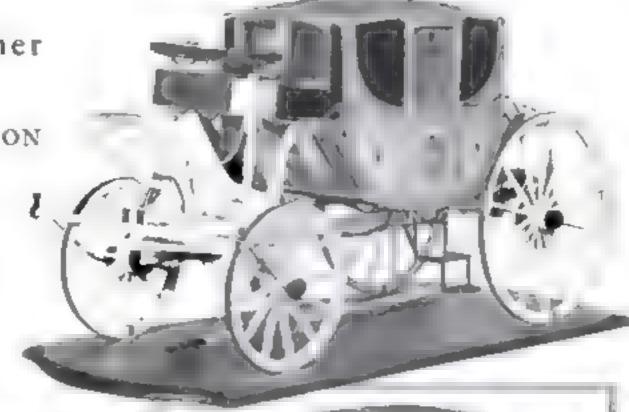
First Prize Winner in our

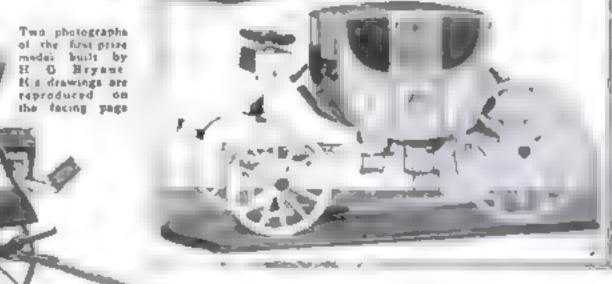
GEORGE WASHINGTON

COACH CONTEST

RELY has a coach model of finer craftsmanship or more graceful design been built than that which wen first prize of \$.00 in our George Washington coach model content it is the work of H G. Bryant, of New York and was built on a scale of 16 in equals 1 in, from careful measurements and sketches he made of the original coach, which is now in the possession of the New York Elistorical Society

The coach was owned by the Beekman family in Revolutionary times and, ac-



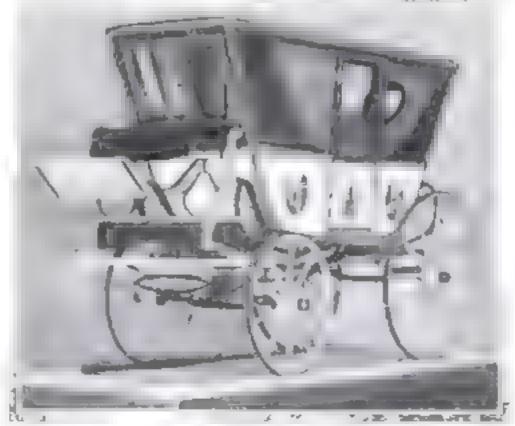


Third prise-is small model of Washington's insugural statch made by Frint Swens

cotding to be family to citions was used occamonally by Washington when he was visiting New York

The drawings are teprocuced on the following page. In the few places where Mr. Bryant has inserted dimensions on the drawings, he has given the dimensions of the coach itself, not the model.

The wheels are pale yellow, the body is russet yellow except the curved spaces at each side of the top shuttered opening in the door and the upper part of the front and back chas which are brack. The top is also black. The decorations are dark blue with red stars in the



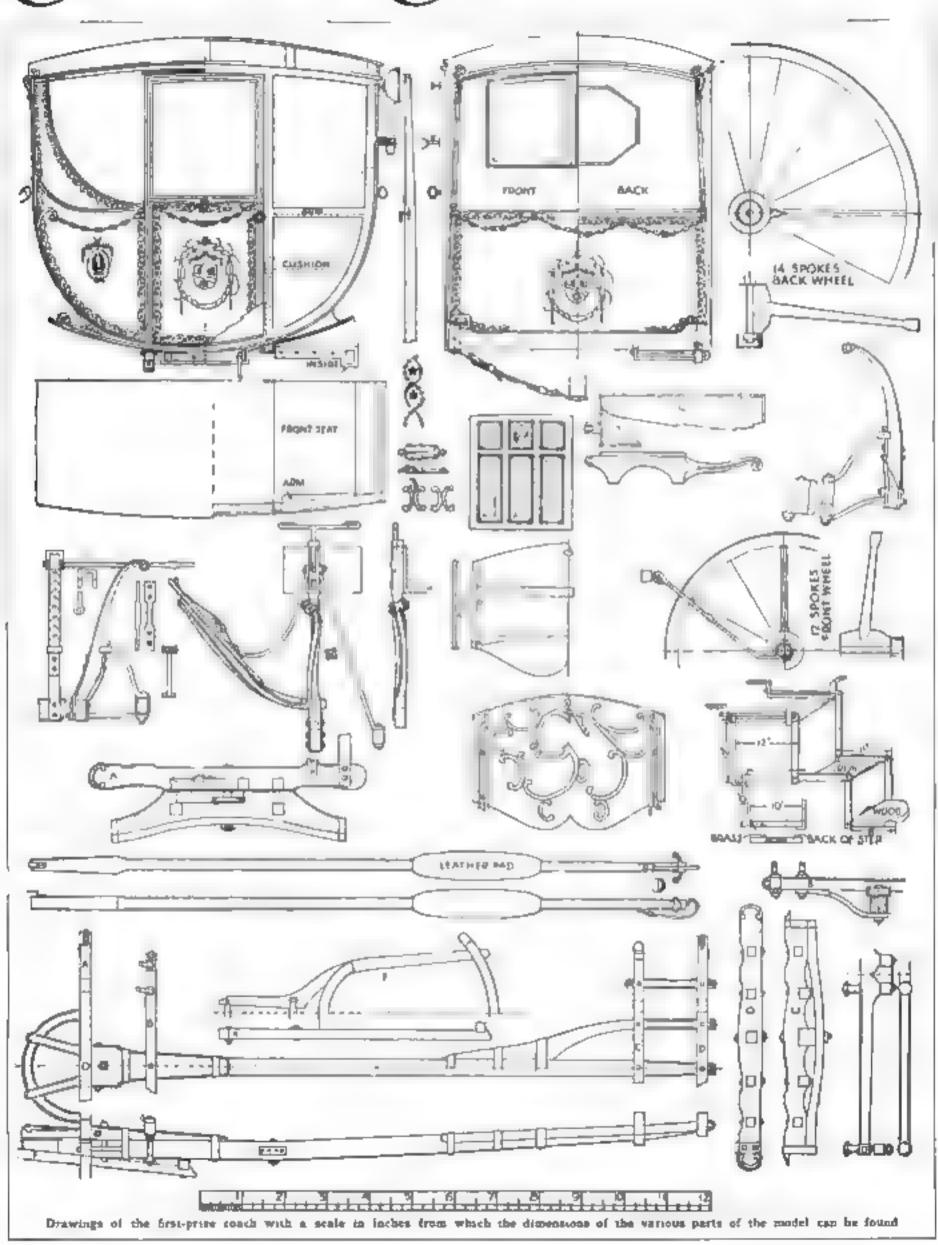
This carefully detailed and well-finished model by Harry Bock won second price. It is the mangural coach built on a scale of '5 in equals 1 in.

painted penamentation around the door opening. All the carved work is gold. The small ovals have a red ground, a black

eagle, and are out ned with a garland of pink rosen and green leaves. The coat of arms is yettow with two red roses and a black figure. The field on which the shield is placed in blue with red and yeslow drapery and a fine red line about it. The upholstery is white broadcloth, and the upholstery of the back of the rear seat is extended to the top of the coath.

The second prise of \$ 5 went to Harry Bock, of Manchester, VI., for a model of Washington's inaugural coach which he built entirely from the information contained in the article published at the time the competition was announced (P S. M., Aug \$2 \text{ p 6 } \text{ Fehr Sweins of Eureka Cahi, gained the shird prize of \$15 with a 1 16 in scale model

Golonial Goach Model



True Up Worn Drill Chucks

By Hector J. Chamberland

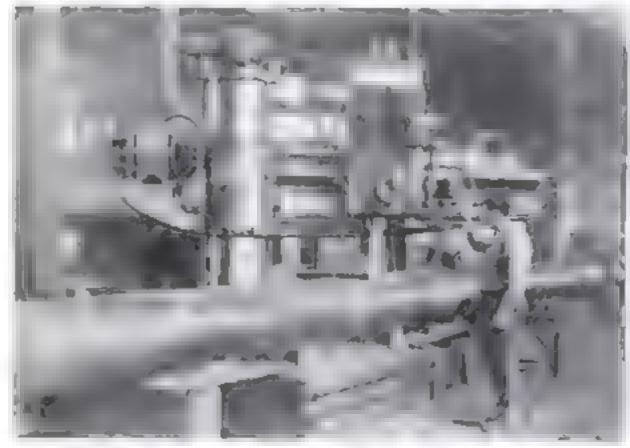
and other useful machine shop hints

Paright and radial drills have standard chuck equipment of the type shown at A in the accompanying drawings. These chucks come in different sizes to take shanks or round stock up to 1 in. While they are mechanically well designed for long service, they are subject to much abuse through no fault of their own and thus are likely to become inaccurate.

In considering the care of the drill chack, we shall also give some suggestions in this article on the upkeep of small drills under ½ in, or the so-called "wire" drills. The economical maintenance of larger drills was covered in a previous article (P. S. M., Nov. '32, p. 78).

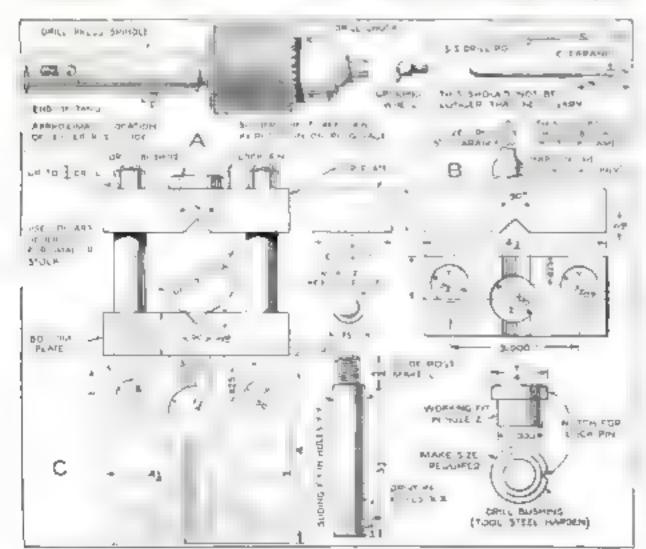
Let us see first what we can do about

Let us see first what we can do about repairing the chuck. Every machinist knows the condition of the average wire dril shank, it is often so battered that it will cause the drill to run out and seriously damage the chuck. A bad trick practiced by many mechanics is this, if the drill shows any sign of being out of true the operator will juck up anything bandy and bang the drill right and left until it appears to spin ail right. This carelessness results in a crooked drill and throws a strain on the chuck juws becommany an overhauling is tequired to restore the concentricity of the chuck.

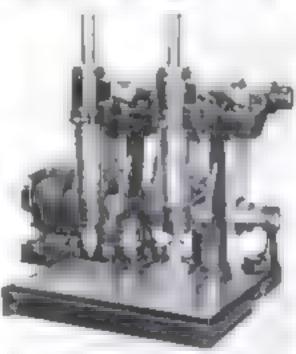


Successful drafting requires a properly ground did I point and absolute tig dity. In this case 642 boing 2 in in diameter are being drilled in a steel header within timity of 92 (h.

To make a good job of it, the spinule is removed from its bearing or sleeve so that the socket can be trued. The spinule is minuted in the usual way in the lathe or universal grinder, using the required.



How chuck jaws are soldered so that they can be grown (A), a flat drill for finishing small holes (B) and a sumple fixture for drilling cross below in much up to 2 in, in diameter (C)



The other extreme In drilling small holes the chuck deserves as much care as the drill

taper plug gage to get the location of the steady rest. After setting for the correct Morse taper, remove just enough stock to true the bearing. It should indicate within .001 in, with the plug gage.

Once this operation is completed, the thuck is inserted in the socket for grinding the bearing surfaces of the jaws. The jaws must, of course, be ground in their gripping position; if not, all this time would be wasted. This is easily done by closing the three jaws on a plug gage of a diameter about two-thirds the capacity of the chuck and soldering them at the location indicated in drawing A. The jaws should be tightened lightly enough to allow the plug page to be pulled out.

When the table has been set for a perfettly straight grinding job, the jaws are spotted until all show clean and free from marks. The sorder is removed and the chuck shank is touched up on the cylindrical grinder by closing the jaws on a short piece of rentered stock. Even with some wear in the ways of the sliding members this complete repair job restores almost the original accuracy. Later, when the chuck jaws become completely worn out, they may, of course, be replaced at relatively small cost,

NCE the spindle and chuck are in good condition, the problem is to hold the desired use with a small drill. It seems here that we must turn the bag inside outafter insisting un machine ground drills in our previous article, we find we have to depend on skillful hands and good vision for grinding the smaller sizes. There are machines to grind drills as small as 16 in., but they are not to be found in the average shop.

Unake large drills small ones should be point-ground on the face of the wheel instead of the side Drule from 3/16 to 1/2 in in size may be tested with the gage, for smaller sizes, a magnifying glass will help materially. With a few minutes practice each day, any machinist can become quite proficient. When granding a small drill, let the wrists govern the up-anddown movement and not the arms as a whole If you assume the correct posture and once find the right spot on the wheel you will soon become an expert It is mainly a mainly of patriataking care and persistent practice

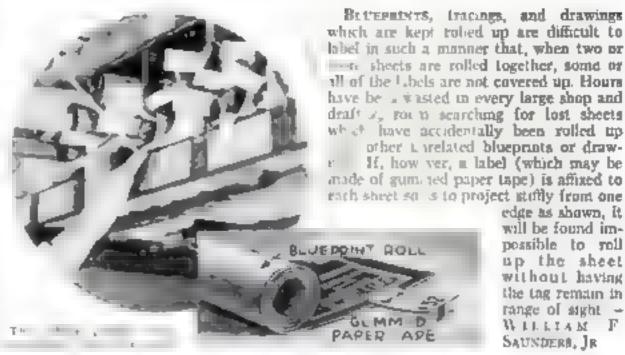
Many small drills break from poor grinding but an equal number fail because of maufficient speed. A drill can be compared to a grinding wheel-the gnaller the drill, the faster it must travel to result the feed, Bear in mand, therefore, that too slow a speed is just as bad for a small drall as too fast a speed for a large one

IT IS more often necessary to drill an accurate hole with a small drill than with large slaes, for the reason that it is impossible to keep in stock so many small. reamers. A new wire drill, no matter how accurately sharpened, will cut at least .001 in oversize, If a standard hole is essent a.. it will be necessary to reduce the length of the drill by about 1/2 in Sometimes stoning .0005 in, from each up will keep the bole within long s

When a substantial number of holes have to be held to a plug gage, a good way is to use a twist drill the next size smaller and make a flat drill as shown at B for finishing the hole. If the dimension required is between standard sizes of drill tod, the rod may be turned and filed. This small tool is really an inexpensive reamer but it will hold its size within surprisingly close bmits.

Locating cross holes is a familiar operation in every shop. This can be done accurately in the milling machine, but it is not advisable to resort to the use of that machine except for regular jig and fixsure work. For cross drilling, the device shown at C is a real timesaver. It operaces on the idea of a die set and has a range up to 2 m, for stock and 34 in for the cross hole. Since it is made of machinery steel and not hardened except for the drill bushings, the device is inexpensive

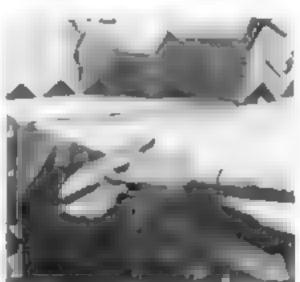
LABELING ROLLED-UP BLUEPRINTS



BRICKS LOWERED SAFELY IN WELDED METAL HOD

SAPE, easily handled hads for lowering brick into cesspools, sewers, and other openings below ground may be made as shown in the photograph below, from No. to gage metal and a length of 1/2-in. rod A rectangular sheet is bent to form three tides of the bod, which is of a size to hold tivelve bricks. A square sheet for the bottom is then alit about 1 in, at two curners, the edges being turned up that distance to lap over the end of the folded side sheet. The bottom is then securely tack-welded in place. The rod is bent and each rad welded to the outside of the hod at an angle as indicated so that the bricks w. I not fall out when the had is suspended at the end of a rope and lowered into the working space.— C. Coyle.





edge as shown, it will be found im-

possible to rell

up the sheet

without having

the tag remain in range of sight -

WILLIAM F

SAUNDERS, JR

SPECIAL TURNING BAR FOR STEEL BEAMS

A san with a binged Jaw, like that illustrated above, will prevent accidents in turning heavy steel beams. For the sake of lightness, the bar steel may be of pipe To the end of this is weided a fork or cleves, the jaws of which are 1/4 by 2 in., or beavier if desired. Between the ends of these jaws is loosely riveted a section of 14-in, steel plate with a gap cut in one end and with the other end projecting so as to catch against the soud heel of the clevis. The gap may be of any size needed, and may be corrugated and hardened to prevent slipping. A steel beam cannot be turned without placing the bar in proper position, it will then hold until the beam is overbalanced, when it will automatically release the flange over which it is placed.

Old Bill Says . . .

MALL internal grinding wheels can be made from broken or disearded surface grinder wheels by drilling a bale with a round file and then dreaming the fragment of absence with a diamond while in place on the spendle,

If you expect to obtain occuracy when cutting a dear see that the teeth of the cutter are perfectly reduct.

It is a good plan to use a little white or red lead on press fits. You may sometime have to press them out yourself?





Useful Kinks for CAR OWNERS

Our Readers Supply Valuable Hints for All Who Work on Automobiles

IN RAINY weather or just after the car has been washed, closed-car window grasses often tend to stick and hind in the felt sash channels. This can be overcome by lowering the windows and greasing the grades with a small wedge shaved from a bar of white soap. The pointed end of the soap wruge is placed in the felt raceway and given a few strakes up and down, the full length of the channels. Unlike grease or oil, the white soap will not discolar or rot the felt.—A, J. H.

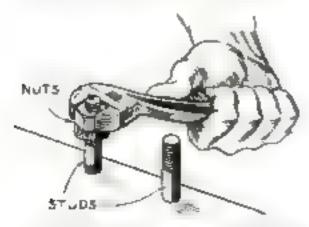
Hinges for Door Stops



Ondinany strap hanges can be used as theap and etherent stops for swingng garage doors. As shown In the drawing, the hinge is placed so that the short leaf drops far enough below the lower edge of the door to catch in the ground or surface of the driveway The flexible wire life serves to hold the hinge leaf out of the way when it is not in use and also permits lowering the stop without reaching or stooping -K C

To Remove Studs

By Locking two nots on a stud, you can replace it or remove it easily with an ordinary wrench. First, acrew two nots on the stud and lock them, one against the other by using two wrenches. Then turn the lower nut to remove the stud or the upper nut in the reverse direction to replace it. One nut serves as a locking nut for the other in both operations. To remove the nuts, simply unlock them by pucing a wrench on each and turning them in opposite directions.—H. F

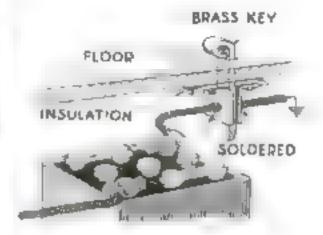


By placing a wrench on one of two nuts locked together, study can be removed or replaced



Mirror Reduces Danger

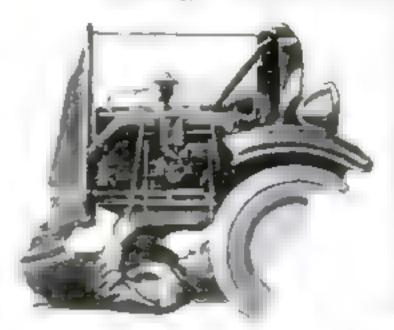
A MEDIL M-SIZED Intrior, mounted on a pole outside of a blind driveway and adjusted to reflect the main road, is good insurance against accidents. When carefully adjusted, the mirror will give the driver of a car leaving the driveway a full view of the blind road to spite of fences, trees, and bushes that otherwise obstruct the view. If the drive enters the road at right angles, a mirror can be placed on each side. When a car reaches a certain point on the drive, a quick glance at each mirror will tell the driver the coods ion of the traffic in both directions.—G. E. K.



Hidden Lock in Car to Thwart Thieves

As an added protection against thiever you can equip your car with the simple hidden lock as shown above. The lock consists of a short strip of brass that completes the battery ground connection when it is pushed through a small rectangular hole in the floor boards under the draver a reat. Cut the ground cable in two and solder a one inch square of sheet copper to each end. These termina's are then fastened in place under the floor boards on each side of the key hole. A piece of inner tube should be used to insulate the terminals from the floor board. When the key is in place the ground circuit is complete but when the key is withdrawn no power can be obtained from the battery While the metal contacts under the floor boards should be authorest springy to grip the key tightly, they should not touch when the key is removed. Of course, this switch was control the entire electrical system, including light,-R. S.

Putting a Crankease Back in Place



THE JUS of putting a heavy crankcase back into piace can be made a simple one-man affair by rigging a length of rope as shown at the left. One end of the rope is fastened to the frame of the car on one side and then placed under the trankcase. The other end is looped over the manifold on the opposite side of the engine and provides a simple pulley arrangement for lifting the crankcase. One hand can be used to pull the rope while the other is free to start the bods. If the crankcase is long, two ropes can be used, one being placed at each end .-- W H.

THIS NEW TIRE WILL SAVE LIVES

Remarkable new invention makes safest tire ever built 3 times safer from blow-outs No extra cost to public

His is probably the most vital single announcement. I ever made about a tire, it's the story of an amazing invention that will save thousands of lives . . . maybe your life . . . and prevent thousands of thuse accidents that main and cripple people.

Today's high speeds—40, 50, 60 and 70—cause terrific heat insule the tire. Rubber and fabric begin to separate. A bluster starts . . . and grows bigger and bigger. Then suddenly . . . BANG! A blow-out! A terrible drag sets in . . . you can't steer . . . and then smash!

To protect you from blow-outs every new Goodrich Safety Silvertown Tire has the amuting new Life-Saver Golden Ply. This new invention resists terrific heat. Fuhric and rubber don't separate. Thus blisters don't form inside the tire. Blow-outs are prevented before they even start.

Safer at high speeds

At gruelling speeds on the world's fastest track, the new Goodrich Safety Silvertown, with Life-Saver Golden Ply lasted three times as long as first quality tires that did not have this feature. These SILVERTOWNS sever blew. They were rup notil the trend was gone—but the Life-Saver Golden Ply refused to give!

Safest anti-skid tread

The tread, too, is safer from skidding. Even on wet, alippery pavements, the squeegee drying action of this famous tread gives your car extra road-grip and reduces danger of skidding to the minimum.

Put this Silvertown Tire on year car. Look up your Goodrich dealer's name under the classification "Tires" to your classified telephone directory. Put real protection between you and the highway.



FREE This handsome Safety League emblem with red crystal reflector to protect you if your tail light goes out. No obligation. Just join the Silventown Safety League. Traffic Officials endorse Safety League membership. Write today, Dept. 155, The B. F. Goodrich Rubber Co., Akron, Ohio.





The NEW

Goodrich Saffery Silvertown WITH LIFE-SAVER GOLDEN PLY

Better Snapshots

AND HOW TO TAKE THEM

Simple ways to avoid getting them too contrasty or too flat and shadowless

By Frederick D. Ryder, Jr.

Fig. 1. A steptive can usually be anved by all entrealment of you can nee the details on the clear portions when it is held before an illum nated ground glass or the sky veloper that was 100 warm. Third, the negative may have been printed on extra hard, or contrast, paper

An extremely important point, too, is that these errors are cumulative. No serious error was made in taking or processing the picture of Fig. 2. It was only a tritle underexposed the developer was only a little too warm (four degrees in fact), the (Continued on page 7-2)

OU have taked quite often about how important it is to get the lighting right if you want good, clear, snappy photographs," writes a Populan Science McNithly reader, "and your instructions have helped me on indoor and outdoor pictures, too, when I had time to wait for the sun to get in the right position But what I want to know is how to get hetter results on ordinary snapshots—the kind where you take the light as it is or go without a picture

The answer is all a matter of learning how to control the range of contrasts in your photographs, or, in other words to adjust the relative letensity of the light and dark areas of the picture

If you get barsh, black and white pretures—Fig. 2 is a Typical example several though may be wrong. First, the exposure you gave when you took the picture may have been too short. Second, the film may have been developed too long in normal developer, in developer that was too strong or in normal de-





Figs. and 3 Siight errors in the picture at the end are it the appearance of soot and whitewash. The other view. Fig. 3) shows how it looks when properly taken and finished

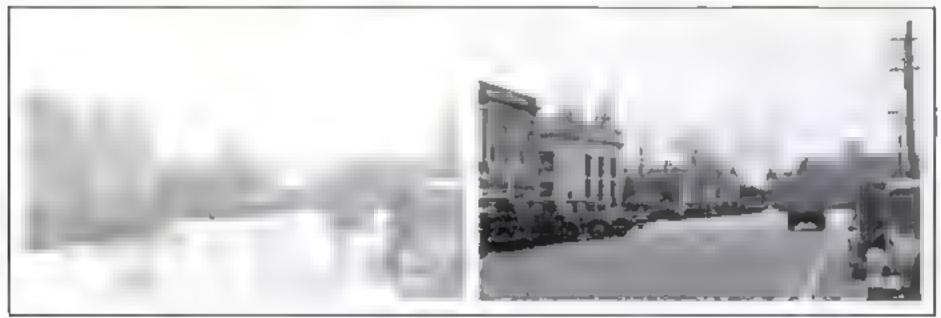


Fig. 4. Many views taken on duli days turn out that and mainted esting. This und was a prife overexposed, then developed too fast in all ghely chilled and stake developer, and printed up soft paper

Fig. 3. This is the same acree but the slight technical errors which runned Fig. 4 have been corrected. The point was made on a more contrasty paper to compensate for the dead, flat sighting

EASTMAN NEWS BULLETIN FOR THE

AMATEUR PHOTOGRAPHER

MAY, 1933, PUBLISHED BY EASTMAN KODAK COMPANY



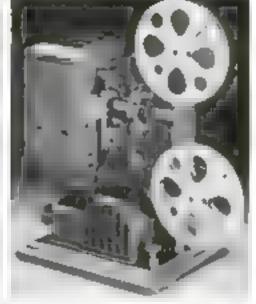
BPERM CIL COSTS 100 TIMES AS MUCE as the rd ordinarily used in movie sameran, yet the driving spring in the new Cine-Rodek Eight is cased and sealed in this especialve oil—an instance of the extranse care to iterure long life and perfect eperation of your camers. Note the enrocket terth on the spring caring. Ingenious releaceping of the spring as the drive wheel allows the use of the largest possible motor.



WITHOUT CHANGING the camera from picture-taking position you can adjust the focus and choose the shutter apped of the Endak flur-ro, by means of the secondary abutter and distance scales on top of the camera. See this new Kodak at your dealer's. It has all the leateres that make fine picture making estimat.



NEW CINE-KODAK EIGHT WITH ULTRA-PAST LENS. For those who desire the etmost in 8 millimeter movie-making possibilities-Ciné-Rodah Bight, Madel 60, in the enswer, Its / r.a. lens is an fast an those on the finest 16 com. Cind-Kodaka, and focuses unitially sharp from a feet to infanty. Insuently interchangeable with the regular leas is an /4,5 telephoto less. Model du, with case, \$79.50. Telephote lene extra, \$17.50.



SCREEN PICTURES 30,000 TIMES the area of the tiny florer. Sint proages are still clear and brilliant when projected with the Kodescope Eight, Model do, which gives illumination adequate for g acreen 22 g 30 inches. This time projector has a large shoostet, automalic room-light switch, highspeed suromatic rawind and still-picture device. Price, \$75, with carrying case.







YSO SECONO





1.0 SECOND

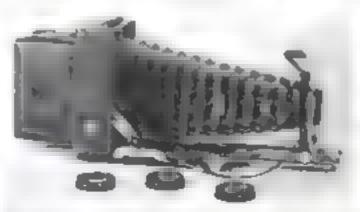


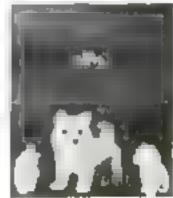


8 SECONOS

A DEMONSTRATION OF FILM LATITUDE. The three pairs of negatives and prints above show the amening exposure letitude of Kodak Verichroma Film. Although the second negative was given 5 limms and the third 400 limes as much exposure as the first, all three made mainfactory prints. This extraordinary exposure range is one reason why ameteurs get better pictures on Verichrome Film.

lf it sın't an Eastman, it ısn't a Kodak





LONG BELLOWS ERINGS SUBJECTS CLOSER How Kodah Reconar closs-upg compare with ordinary camers close-ups is shown in the toy-dog pictures above at the right. The Recomar with its long believe may show upoil objects up to natural sure using its regular lone. Its extra believe hough also permits the use of interpensive numbery leases to bring distant subjects closer With an entitling short-forces leng, the Recommer will take an entremely wide-angle view or show small obpects abmost twice permat size. Rodals Recomer 15 at , x 3t , , Leo: Recomer 32 (3t, x 4t4), Call. Supplementary Jenues, \$2.50 cach. Send coupon for further details about this versatile camera,

SEND COUPON FOR THESE FREE BOOKLETS

Eastman Kedah Company, Rothester, N Y



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Emjalt Sitt-16

Equipment.

Kadak Recomer

Person.

Street

City

Throwing Knives at Target Is Novel Sport



How the target and kn ven are prepared. The blades are well bluefed on that there is no danger of getting a cut

WHAPPLE WIT

25 15 10 5

BURLAP

thing of the novelty and thril of

The equipment can be set up in the cellar in an evening It consists of an old chopping block, three knives (ours cost 10 cents each), a small roll of tire tape, rag hags, two boards, noits, and a little point. The total cost is less than a dollar.

The target A is a block of wood without knots, 1734 in, in diameter and about 15 in, long, Soft pine is best. Saw the face smooth across grain so that knives can enter with the grain. Paint rings as shown at B. Attach a board midway from each end on eather sade, and bang on joists about 52 in, from the floor in such a way that the back can swing back and forth

About 1 ft. behind and, if necessary, to the left and right, tack up rag bags to stop knives and prevent their damage Lay rough boards loosely on the cement floor, under and in front of target. Cover these with rag base or old carpets

An ordinary butcher's limite will serve the purpose. Grind to the shape shown at C for balance, and wrap the handle with tire tape to bold the rivets. Grind and round off the cutting edge up to within about ½ in, of the point and file the point to a blunt, chisel-like edge that u not sharp enough at any place to cut the band. This is important. Experience has shown that although this makes the game safe, it does not interfere with the penetration of the knife. Not one of all who have thrown these knives has ever received even the alightest injury

The position of the knile in the right hand is shown at D. This gives a firm,

steady grip. Stand facing the target 12 fifrom it, knife in hand. With arm over head, elbow bent slightly, swing arm of shoulder foreward and downward.

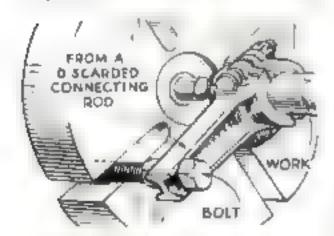
METHOD OF HOLDING KNIFE (TO THROW)

TARGET

SWINGING SUPPORT

C-IOPPING

After throwing three knives, we count score, remove them from target or floor and throw them again until we have thrown 21 knives in 7 sets of 3 each. The accumulated total thus gained is our score. A doubtful knife in the target is measured across its width at the surface of the target. The greatest width in either ring decides the issue, and one exactly half and half is counted on the lower score. Only knives in the target after the third has been thrown are counted. Variations in knives, knife holds distance from target and other concreases will quickly suggest themselves.—W. W



IMPROVISED LATHE DOG

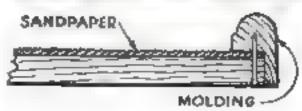
A LATHE dog can be improvised from an old model-T Ford connecting rod. It may be applied to work from ½ to 1½ in, in diameter, a narrow leather strap being used to bush up small work. One advantage is that the Babbitt metal will not injure threads. The cut-off end of the rod is drilled with a ½-in, hole, as shown above, for a bolt.—Earle Strand.

BOARD AIDS IN ASSEMBLING PUZZLES

PICTURE puzzles, especially those made of cardboard, can be solved much easier on a board that is covered with fine sand-paper, blotting paper, or other nonskid substance and that has a rim projecting subtily above the top. The rough surface prevents the puzzle pieces from slipping, and the strips form a framework for keeping the puzzle square

To make such a board, obtain a piece of thin wood, preferably plywood, about 1/2 by 15 m. Cut strips measuring about 3/2 in. one way, and fasten them along the edges so that 1/2 in. projects above the board surface. If you have a shaper or moking cutter, you can make the strips into an attractive form. If sandpaper is to be glued us the board, the No. 00 grade is about right. By employing ordinary sandpaper breces in combination with a darker variety, you can work out an attractive design.—Roy Euros





BETTER SNAPSHOTS

(Continued from page 26)

time was prolonged only a few minutes, and the grade of paper in this particular case was identical with that used to print the picture of Fig. 3, which is the same shot without the errors.

So much for sunny pictures. Now look at Fig. 4. Here is an ordinary street scene taken on a dull, cloudy day in the early afternoon. It was slightly overesposed and developed in developer that was a bit weak (it was slightly stale). The solution was unfortunately, about three degrees too cold and the film was yanked out a minute or two sooner than it should have been. Paper one grade on the solt side was used for the print. And what a print! Nobody could call this one a satisfactory result.

THE same street view with the technical errors corrected appears in Fig. 5. In this case, however, a more contrasty paper was used to make up for the dead, flat lighting of the cloudy day

Modern film, such as verichrome, has great latitude and therefore permits considerable variation from correct exposure without spoiling the picture, but you can't expect detail in the shadows (the eyes in Fig. 2, for example) unless the exposure is long enough (or the film to record them

Fortunately for all of m, the errors we may make in taking pictures and in finishing them, or our photofinisher may make for m, are just as likely to balance out as they are to work all one way. For example, Fig. 2 would hardly have been developed too long in normally strong developer and the solution had been somewhat too cold, and then it had been printed on extra soft paper.

Since none of us has yet reached the in-

Since none of us has yet reached the infallible stage and even the best of photofinishers slip once in a while, the next question is, what's to be done about sunshine pictures that turn out too contrasty and cloudy day views that are too flat?

cloudy day views that are too flat?

Obviously, the first step is to examine the negative to see if the print has done it full justice. As a general rule, all very contrasty negatives, when held in front of an illuminated pround glow as in Fig. 1 or against the sky look fine. The eye sem detail in the shadows which are the light portions of the negative, and does not notice the great differences between the light and dark portions of the negative,

If THE negative shows practically clear film in most of the light portions, in other words if the details of the face cannot be seen even in the negative, then the under-exposure has been too severe and the picture will have to be retaken. If, however detail can be seen at all points in the negative and the only difficulty seems to be too great contrast, reduction, either chemically or by reversel, will give you a matisfactory point. Naturally, before this work is undertaken, make sure that the print has actually been made on the softest paper available. Often the use of a soft printing paper will give you a good picture from a negative that seems hopelessly contrasty on the normal or hard grades

In the case of a too flat picture, such as Fig. 4, the first step is to try printing on a hard grade of paper. This is worth while if the negative shows detail in all ports and the only difficulty seems to be the all-pervading grayness. If the contrasty grade of paper effects an improvement, but the picture still is too flat intensification can be treed. This is a simple chemical process which I need not detail. Anyone can follow the simple directions on the (Continued on page 81)



I spark plugs. Put in a set of those new extra range Champions, and make it enappy. Why, since buying those 'gyp' plugs my car has lost power—won't pick up—bucks like a steer, and is hard to start—they would have been expensive if they gave 'em to me. Bet I've lost in gas alone more than this set of new Champions will cost o I know I'll save with Champions — I've used them for years and know what I'm getting when I buy them—dependable ignition that's what'

 I've learned my lesson once and for all. From now on I'll know who is behind the equipment I buy" o Champion Spark Plug Company, Toledo, Ohio; Windsor, Ontario.



CHAMPION SPARK PLUES Arc Furnace

MELTS ANYTHING

How to wind a simple coil reactance that controls the current, protects the fuses, and cuts down greatly the cost of the electric power

By Alfred P. Lane

EAT so terrific that no known substance is able to withstand it for long can be developed in your home laboratory with nothing more than a pair of electric light carbons, a small crucible, and some means of controlling the flow of the electric current from the house mains through the arc.

Most electrical experimenters attempt to use an old toaster or electric grill in series with the arc. This works all right, but the current flaw is limited to three or four emperes and is greatest when the rarbons are in contact and the arc is producing the least amount of heat. Adding another toaster or grill in parallel with the

first one doubles the current through the arc, doubles the cost of aperation, and still is open to the objection that the current flow is greatest when the arc is least effective.

The difficulty is that a carbon are, operating on the ordinary 60-cycle. 110-volt current, actually requires only about 35 volts. The difference is wasted in useless heat from the grill or toaster.

You can avoid such troubles by building a current limiting reactance to take the place of



Operating a small are furnice with a reactionce that is as effective an ewo sop-west electric guital connected an perstant it is practically an serviceable as a sup-down transformer

the makeshift resistances. The rear ance upsets the power factor of the line in such a way that the current flowing through the arc actually is in the neighborhood of 10 amperes although the meter runs only as fast as though 3½ amperes were flowing

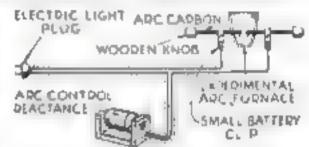
The homemade reactance shown was designed especially for amateux are furnace experiments. The core is made of transformer steel laminations or appealed

> tron strips measuring 1½ by 6 in Enough of them are used to make the core 1½ in, thick

> After the core has been tutbily wound with four or five layers of friction tape, the winding can be started. Use No. 12 enameted, cotton covered wire. The first layer should be 5 in, four, and the end of each succeeding layer should be stepped back half the width of the wire. This gives a

Two views of the coil and a drawing that gives the dimensions of the parts. The core must be clamped down firmly

CORE



How the connections are made. No current can flow without posting through the cuit

cone-shaped effect and avoids the use of retaining disks. Continue winding till the outside of the coll measures 314 in in diameter. Then apply several layers of friction tape to protect the winding and keep it from coming loose at the ends.

He sure that the notches in the upright end pieces of the wooden frame are slightly less than 13% in, deep so that the toppieces will clamp firmly on the ends of the core

Connections are made to the coil by drilling a hole in the upright, passing the end of a flexible cord through it, and soidering the coil end wires to the bared ends of the cord. A soldered loop should be formed in each wire so they may be firmly clamped to the inside of the upright by means of small, roundheaded wood screws.

After the reactance is finished, give it a coat of black point or lacquer.

A handy wiring harness for are experiments is suggested in the diagram above. The metal or other substance to be melted

can be placed in a smaller crucible suspended within the outer one. Obviously, any desired type of furnace may be built to suit the work. Bear in mind, however, that the heat is intense enough to melt from and porcelain and must be cautiously used. Do not look directly at the arc without wearing gogges.

This reactance is for use only on 60-cycle, 1.0-volt A. C current



(0)

BETTER SNAPSHOTS

Continued from page 79,

packages of the prepared intensifiers which are to be had at any photo supply store Reversal also does the trick if process out film or plates are used. Reversal either to intensify or reduce the contrast, is exactly the same process. It is carried out by making a contact print from the original pegative, using a plate or cut film instead of the usual printing paper. After this positive is de-veloped, fixed, washed and dried, another plate or cut film is taken from the box and is printed from the newly made positive Developing, fixing, washing, and drying this second plate or cut film gives you a new negative. If you use strong developer and process flun, the new negative will have much more contrast than the original. If you use commercial plates or cut film and weak theveloper, the resulting new negative will have less contrast than the original. The reversal process can, therefore, be made to give any kind of a new negative you want Furthermore, the original negative is not altered or harmed in any way

In any case, no scheme of after treatment in worth the trouble if it is reasonably easy

to take the picture over seaso.

The whole matter of griting the right confrast can be summed up in a few words. Make sure that you give a full exposure on all sunight pictures. When the lighting is exceedingly harsb, it is better to double the exposure recommended by the exposure tables than to take a chance on excessive contrast keep the exposure on the low side on all pictures where the lighting is soft and without bravy shapows

If you do your own photolinishing, standardire your process throughout

Prizes Awarded for Christmas Photos

PRIZES have been awarded as follows in the third of our \$100 photo contests (P.S.M., Jan. '33 p. 72) which was on the subject of indoor Christmas pictures

FIRST PRIZE 850 Charles J. Belden, Pitchforb, Wyo

SECOND PRIZE, \$25 D' Keibel, West Adis, West.

THIRD PRIZE, \$10. Mary Dierdorf, Paradeno, Calif.

FOURTH PRIZE, \$5 S. Beliaeff, Bloomfield, N. J.

> FIFTH PRIZE, 88 Holger H. Van Allee, Saratoga Springs & Y

SIXTH PRIZE, SS William H Evans. Huntington Park, Calif.

HONORABLE MENTION I course Price Bell, Akron, N. Y : Harold Begler, Canton, Okto; Ana Forbringer, Summit, N. J., R. L. Harmon, St. Paul, Minn., E. L. Knapp, Lawrenceville, Pa., Herman G. Muelke, But-talo, N. V.; John S. Wheeler Woon-socket R. I. Roy E. Young, San Augelo, Tex., and Samuel Paul Zito, Stagara Falls, N. Y.

The winners of the February contest will be announced pest mouth.

You're a shrewd Car-Buyer..

but . . . do you know how to safeguard your investment? Read this bit of bookkeeping from a Kansas driver:

"Herewith a complete cost analysis on my cur, which I have just traded in for a 1932 model

"Time of operation, Nov. 7, 1928 to Mar, 14, 1932 5 yrs. 4 mos. 1 wk. Total miles run, 103,000.

Parchase price \$1,115.00 Total operating & upkeep , 2,512.76

Selling price (trade-in) . . . \$ 300.00 Net cost 3,327 76 Cost per ml. @ 103,000 3.25c *

"This cur, when turned in, has the original rings, purious, and connecting rods had never been taken up. Quaker Scare was used throughout its life."

Do you, too, want to motor at rock-bottom cost? Use Quaker State. Avoid common oil. Every gallon averages about 3 quarts of motor lubricant and I quart of "light-end" oil. This light-end oil burns up in high-speed motors after a hundred miles or so

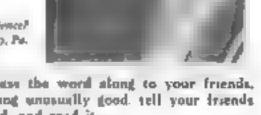
Quaker State takes out this light-end material ... at the refinery, You get 4 quarts motor lubriquist per gallon, net. After a hundred miles or so, you still have 4 quaits.

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SIX JIG SAW

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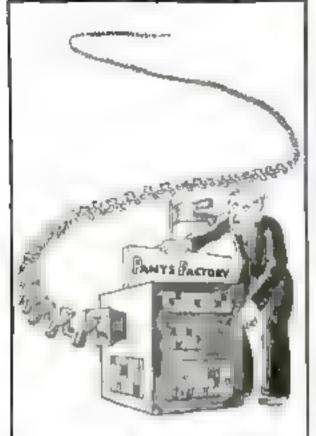




Two Big Federica

Meter Beam 8495 and up FULL LENGTH SPRAY MAILS - SOMETHING NEW A TYT Family Outboard motor has with full length spray cut's took - et piace wantee-throago Mario ion. et prace and usus prize in Mit-

Cutaing Fron-Sare Mestry-Protect Shipmen Phase state kind of 'not in which you are interested. THOMPSON BROS. BOAT MFG, CO. (c)



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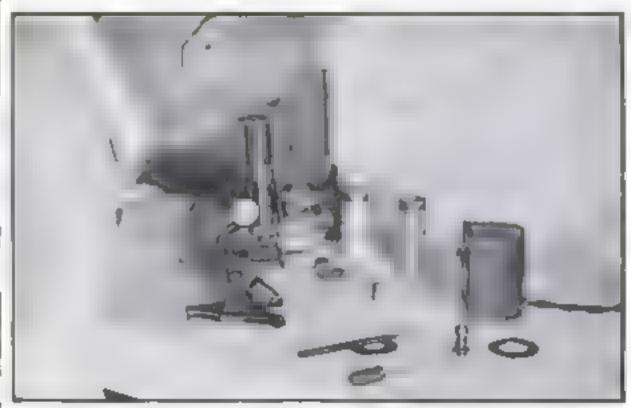
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disadying a specimen in the illumination of an adjustable homemade imp. It has a tent cell that allows various glasses and disphragms to be used to regulate the light

Microscope Lamp

BUILT AT LOW COST

THE professional microscopist considers his light nearly equivalent in importance to the lenses he mes in his instrument, and chooses and adjusts it with equal cure and discrimination. The amateur or student soon learns how ensential it is to have a reliable and definitely controllable source of light for his work. Too strong a light for his work. Too strong a light invariably leads to headsthe and cytotesis, insufficient illumination is simply out of the question.

The accompanying photographs illustrate the construction of a peac tical microscope lamp which the average amateur craftsman can build for himself at little or no expense. The materials are such as may mually be found about the house

The body of the lamp shown to 3½ in, both by 2½ in, wide over all, it was formed from a small piece of thin sheet metal, with a groove or channel at either side to receive the front panel, or door, containing

the lens cell, which is shown in the circle. The lens cell complete, including both outer and inner threads, was cut from the front end of a flash light. The shallow compart ment or porket formed by the depth of the threaded portion provides the cell for the reception of a variety of lenses disphracies, or coor screens which may be readily changed or adjusted by means of the screw cap. The inner threaded portion is suldered into a suitable opening in the door panel.

A number of lenses of varying degrees of density or color may be secured from "sun" or dark" glasses to suit the individual requirements. The diaphragms or stops for recutating the amount of eight that passes may be cut from thin vulcanized fiber for tard-board) with different sized openings as desired. The screw cap boids them tightly

A small 110-volt lamp with candelabra hase, of the outside frosted type, and a base,



The lamp in its housing and the front panel which carries the cell for holding glasses and disphragms

a length of lamp cord, and an allachment plug complete the device. Although the lamp gets raiber warm, it was not found necessary to provide for very ation, but this could be easily done if desired.

finish the casing with aluminum paint on the baside and use what ever color you desire for the outside, and you will have as fine a microscope lamp as any professional could desire—R. Gerald Bullako,

SHELLAC FASTENS HOSE WASHER

When the garden hose was moved for various uses in the yard, parage, and laundry, it often happened that the coupling washer would be lost. Thu caused an irritating delay while another washer was being obtained, but it was finally prevented by fastening the washer securely in place with orange shellar,—RALPH M. McPherson,

Novel Jig-Saw Puzzle

MADE IN FORM OF CUBE

 B_y George S. Greene

HIS new and up usual type of firsaw puzzle forms a cube when pasembles. and has a different picture on each of its six sides. When the parts are spread out and wel shuffled on the table. they resemble those of on ordinary picture puzzle except that some of the pieces have no indication of pictures on them at all to aid in the assembly.

A convenient size to make the puzzle is I in in each dimension. Twelve 3-in, squares of some thoroughly dry, close grained wood 1, in

thick are piaces in a comp, and the six faces are smoothly sanded. Muote is an excellent would for this purpose in available

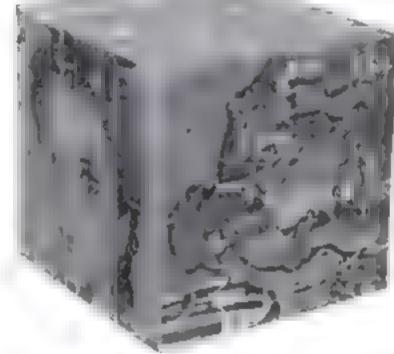
Each rule is then cov-

ered with a picture

Small sections cut from

colorful magazine covers are suitable. The adhesive used must be a good one, such as white case a give-the type ordinarily designated as No. 2. Mix the dry powder in cold water in the proportions of one part pow lerto from I's to I' parts water. Apply the glue after it has been mixed until there are no lumps, with a stiff, short brush to thrust

together, assemble each square first, then bring the squares together so the pictures line up



The assemb ed puzzie has a different picture on each side



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Unusual Butler's Table

has removable tray with folding sides

By HERMAN HJORTH
Author of How to Make Tenered Panels

AMONG the more expensive of the many varieties of small tables so much in vogue in the modern bome, the su-called "hutler's table" is one of the most unusual and serviceable. It may be made of any good cannot would

The frame consists of four legs and four rule joined with mortise and tenon joints. In addition, if deared, a light plywood top may be

fastened on top, as indicated in the illustration at the right. In that case four rubber headed nails are set in the bottom of the removable tray which rests on the plywood top in the original table, however, the top frame was left open and small brocks were glued to underside of tray to hold it in place when set on the frame.

The legs of this particular table are of the cabriole type and were made as



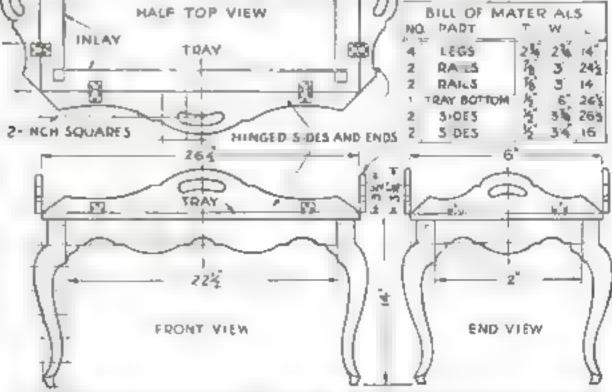
For carrying food from the A tchen the tray has a'l addes turned up, end it is san y hand ad from one to another

explained in previous art rice see especially P S. M., Aug '31, p 106). The design may be medified by using either turned or square sees.

The tray bottom may be plywood or sold wood, either plain
or mail or it may be tenested.
There are time binged spicyteres.
It is best to make the mentions in
these betwee sawing the melione.
Hore a \$6 in hole at both ends of
the opening and then cut away the waste.

wood with a coping or jig sau. The hinges used are brass desk butta. Pick





Working drawings and material I so. The legs are made from 214 in square stock, but small corner blocks are gloed to place between the legs and the raids after the frame is gived up

LOOSE: HANDLES

MIX a little Smooth-On Np. 1 into a putty, put this into the opening, force the parts together, and in a lew manutes the metallizing of the Smooth On produces lasting tightness. Such repairs cost only several cents each and save many dollars otherwise spent for renewals that are no better.

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success to any meta). Use it also for anchoring and taking up looseness. Makes 10000 bolts, nais, screws. etc., permanently tight Holds in masonry, tiled walls, slate, wood, etc.

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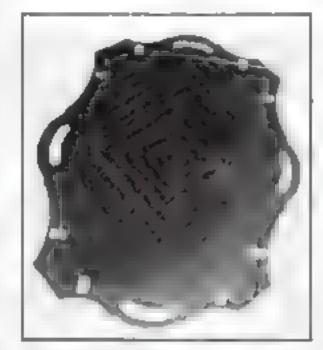
Orpt P Model Ship Supply Co. Misseds, N. 1

The Vest Pocket Cushing

An 5 Couple Publication are Law torseld in the action applies the attended to several theorem and torseld for the action of the first tenders are also acted to the first tenders to the action of the first tenders to the action of the first tenders to the action of the first tenders to

Popular Science Monthly 201 6th Ave. New York City

out ones that are of good quality and open stiffly so that the sides of the tray will stand up by themselves. The length of the joint is 14 in., and the honges measure 1 5 to in. when open. The strew boles in the hinges are countersunk on the reverse side with an ordinary rose countersink. Since they are already countersunk on the right side, this will have the effect of enlarging the holes, therefore use thicker brass screws, such as 46-in. No. 5. Mark the position of the hiners curefully, using a sharp knife point, and cheel a recess equal in depth to the thickness of the leaves. Place the hinges with the knuckie down and cut a small groove for the latter so that the leaves can be set flush with the

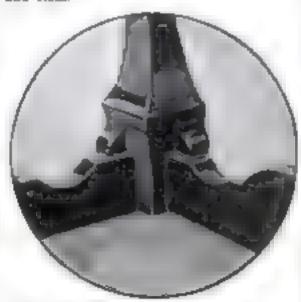


The tray with its a dea turned down. The brane hinges are set flush with the surface

surface it is necessary to plane a small chamfer about 1/4 in, unde on the upper edges of the tray bottom and sides

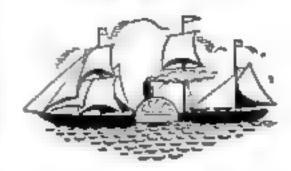
After the wood has been stained to the desired color, it may be finished with four or five emits of very thin shellar. A very good trade of shellar must be used, and it should be mired with denatured alcoholuntil it is no thin he water. Each coat should be allowed from two to four hours for drying, after which it should be rubbed down with No. 3 0 steel wool or No. 4.0 waterproof sandpaper. The successive coats of shellar gradually fill up the fine ports in the wood and produce a beautiful soft finish. The final coat should be rubbed down with a felt pad, powdered pumice stone, and add.

The horges are usually left in the original bright brass finish, but they can be toned down, if desired, with a mixture of shellar and start.



Detail of the frame, set upside down to show part cularly the blocks between legs and rails.

A PACKET of 1870



but you'd sail now on a MODERN LINER

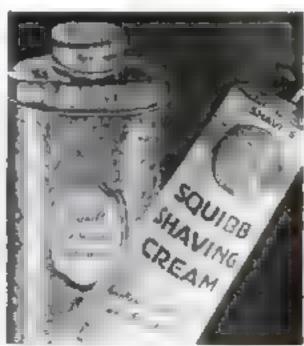
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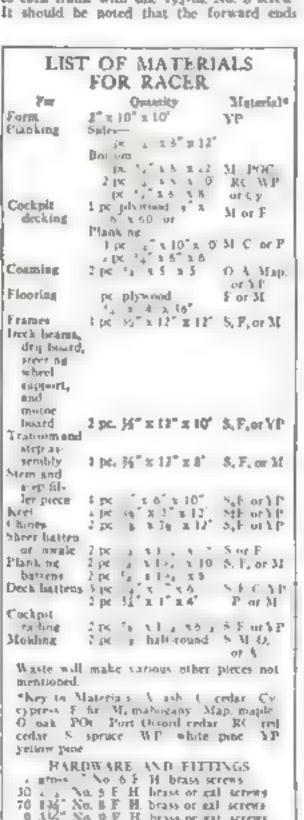
OUTBOARD SPEEDSTER WILL WIN RACES

Continued from page 61,

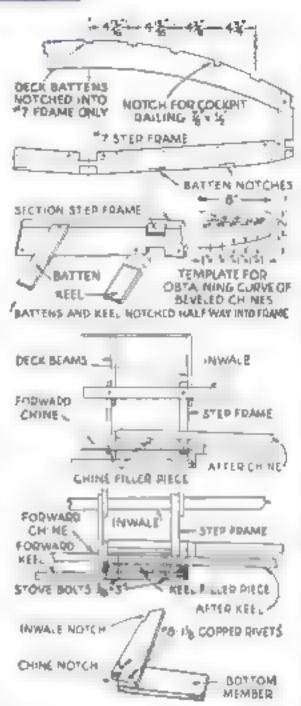
is attached. The step filler piece is next fitted coated with casein glue, and inserted between the ends of the kee, at the step. Two 3 to-in hojes are drilled through the ends of the keel and filler piece, and 3/16-in. stove bolts inserted. The nuts are drawn tight when the frame is turned over. See the arawines on this page for details of the step öffer piece,

The transom and step frame are squared and held by nailing pieces temporarily from the transom and step 10 the keel.

The after chines are clamped in place and the after frames squared. Fasten the chanes to each frame with one 144-in. No. 8 screw



10 . 1 No. 5 F. H. brass or gal screws
70 136 No. 6 F. H. brass or gal screws
9 316 No. 9 F. H. brass or gal screws
1 fb. No. 3 136 copper rivels and burrs
1 No. 3 136 copper rivels and burrs 1/2 lb. 16" copper cut clout nails 2 oz. 16" copper or gal, tacks qt. aviation give (liquid) 1/2 gal nitrate wing dope gal spur varoub 55 th. casein glue (waterproof) 2 3° a 3/t6° F. H. stove bolts. I outboard int us handle. outboard strering wheel 20 ft 2 ter capie I outboard on about 5" x 10" (aluminum) a toller rape pa levs Steige of clieb or use between lastens and



How the frames are notched details of the etep, and other views to help the builder

of the after chines butt against frame No. 6. Both forward chines are fastened simulaneously to prevent pulling the frame out of shape. The forward ends of the chines are sawn to shape and screwed to each side of the keel with one 1½-in. No. 8 acrew, as shown

The chine filler piece between frames Nos. 6 and 7 is now fitted and fastened with two 134-in. No. 8 screws. Coat the filler piece with casein glue before fastening.

The stem is next clamped in place and fastened to the keel with two 144-in, No. 8

After straightening any frame side members that may be out of line, clamp the sheer batten or mwale in place and attach it to each frame side member with one 1-in No. 6 screw, The inwales at the stem are beveled out to nothing and fastened to the chine with one 1-in. No. 8 strew

he entire frame is now trimmed and fa red. A light batten laid over the joints will show

Before planking the sides, level the step and transom frames. If the floor is level, this can be accomplished by measuring from the floor up to the frames. By clamping wood strips to the step and transom frames, with the other ends of the strips resting upon the floor, the frames may be brought in line with one another This is important because the speed and level riding qualities of the hull depend upon the proper alignment of the two (To Be Continued)





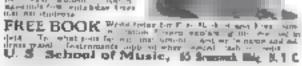
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the wheel form and clamped lightly between the form and not on the shaft. The form and blank are set up in the lathe and cun at top speed. A well greased brass or hard wood tool with a blust end is applied with gradual pressure to the tobacco tin disk until the proper shaps has been obtained The wheel ready for removal is shown at A

Lead to poured into the wheels to elimihate the tin ring which they would otherwe have when roung and also to give better traction. A pair of these wheels are shown in insert B .-] G. Mus was

FILLING AN AQUARIUM

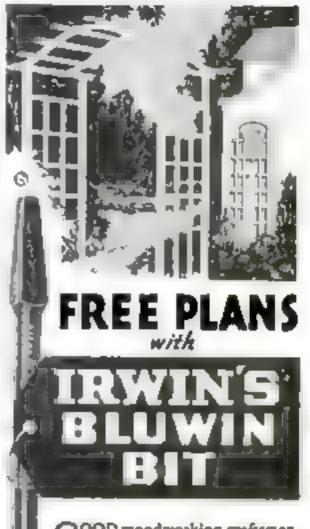


Watte can be added to an aquartum without disturbing the plants and sand if a board is floated on the surface as shown above it should be about 1/4 in. thick, and of suitable size. - W M

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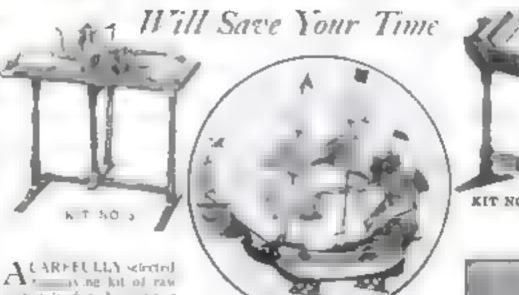
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The other kits available are also shown in the following list Each is accompanied by instructions

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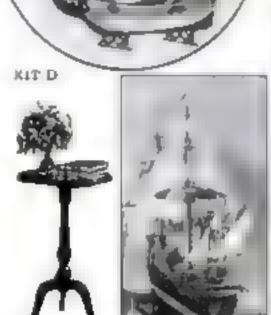
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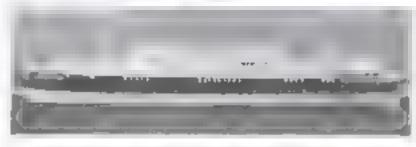
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FINISHING THE HULL OF THE REVENGE

(Continued from page 62)



The knight just all the foremant. It has three sheave holes and an eyebuit at one mide

Elizabethan ships. It is true they were overmanned. Even the Revenge had a crew of 150 mariners, 24 gunners, and 76 soldiers Furthermore, the crew got but ten shill rues a month, was forced to eat the coarsest or food, and had to endure the constant stench of bilge water in the gravel ballast. All that it forgotten, however, and howadays one thinks of the Revenge only as a may ship with decorated units and with flags, banners, and streamers fluttering while she quarters the chops of the English Channel and awaits the mighty Spanish Armada, When the enemy fleet arrived. It did not take long for Drake her fire-esting commander, to catch the great Vuestra Sexora del Rosario and compel ber to strike her colors

Our intention is to make an ornate model of the Revenge without straining too hard for strict accuracy and completeness—in other words, without doing any unnecessary work. How to construct the hull, buildheads, decks, and bulwarks was told last month (PSM., Apr. '33, p. 65). Those who missed that is

See should look at up

Below the helwarks there is a heavy wale. This almost touches the water line at its lowest point, as will be seen in the illustration at the beginning of the article. It was shown clearly in the photographs published last month and also appears on the full size blue, print drawings of the sail plan. This wale will require steaming unless you use chair spline, which is sold for holding machine worse raning in the groover of chair seats. The wale is curried across the stern as shown in the left-hand photograph on page 67.

The next wale up is merely a painted line on the lower edge (Continued on page 91)



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SLIPKNOTS FORM WAMPUM BELT

(Continued from page 03)

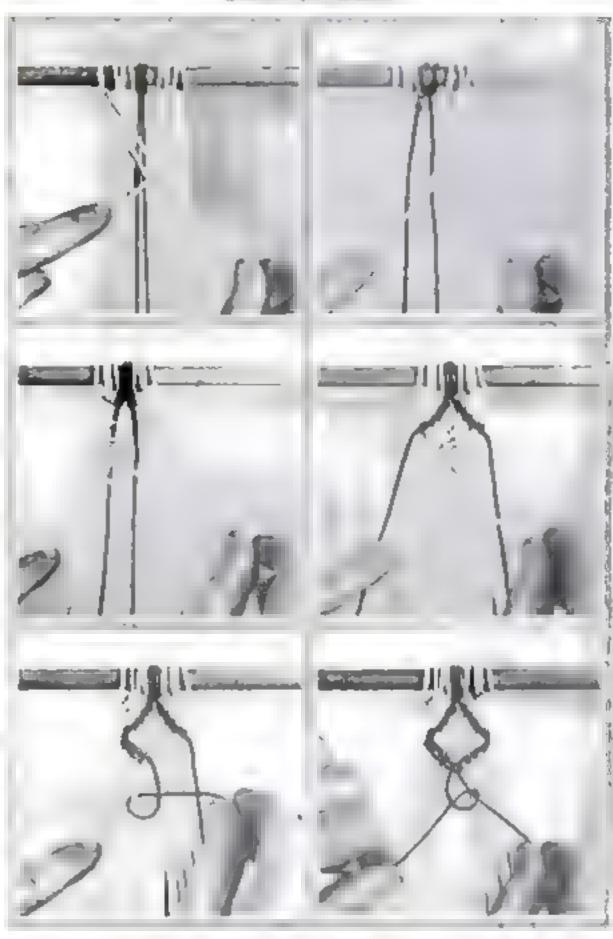


Fig 7 How the twing a done Piest double-knot the second cord over the first forced repeat at the righ band aids out the filters come to the center. Third, knot the two filters cords to the center. Third, knot the two filters cords are at the outside knothing the filters together at each row. Fifth, return the hise cords to the center by knotting them over each of the other cords. Suith, knot blue cords together and continue the process

forms a blue diamond against the gray cord. The process is repeated continuously, and the belt is ended by keeping the blue in the center for a distance of \$ in. as shown in Fig. 3. To do this, reverse all knots made with blue cord. Out the cords ½ in. from the belt, fold over and sew to the back.

By using a clamp and a ruler as shown in Fat 6, the work may be held securely and can be advanced as necessary. The push pips hold the cords to one side and out of the way. To make it easy to handle the long cords, tie them into hanks several feet from the knotting as an Fig. 5.

The design shown at the right of Fig. 4 is made by working the first part of the diamond design continuously without returning

the blue cords to the center. That at the left of Fig. 4 is started from the right by taking the second, cord over the first, then the third second, and first over the fourth, the fifth to first over the sixth, the seventh to first over the eighth. Continue by using the left hand cord as a filler for the others for each row. All knots are left handed

In the design in the center of Fig. 4, a single white cord acts as a continuous filler in the general shape of a letter "Z." Any design can be worked in by knotting the white cord over two blue ones wherever desired.

This is the fourth of a series of articles on knot work (see PS M., Nov. '31, p. 77, Mar, 33, p. 68, and April '13, p. 75;



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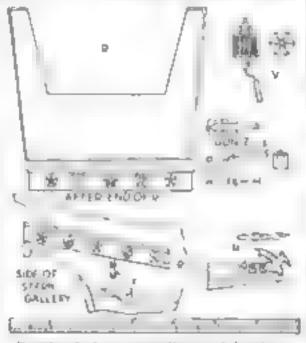
FINISHING THE HULL OF THE REVENGE

(Continued from page 80.

of the bulwarks. The other wales are strips of 3/32 in square wood, glued on Similar strips are gloed at the top edges of the handrails all the way around. The water are painted a dull red everywhere. The handrails on the outside and top are white with slanting red stripes, Inside they are stained brown like the bidwarks.

The stern gallery is a flat board cut to the shape shown at R on this page with 1/2 in. high sides around it and the usual 3 32 in edging. This platform rests on the extension of centerpiece A and has at least one bracket underneath at each side, as shown in detail e The outside of the gallery is colored black with painted shields deputing the Tudor arms and Tudge roses. Astern is the royal cipher E. R. in gold. These can be more easily painted on cardboard and then glued in position

On each side of the main-deck gun ports. slips of wood are glued, and between them



Data in of the avera gallery and brochets, eiern lantern, gunn, and dragen figurehead

shields and roses are painted as on the gallery. A port lid is glued above each gun-deck port. These lids can be the pieces cut out of the bulwark. They are, in addition, fastened with eyebolts made from pint. The (upper) quarter-deck gun ports have doors equal to half the size of the openings. These are glued on each side. All ports are red and have black hinges painted on.

Overlapping 56 in and miled to the front edges of the bulwarks and extending along the beak deck D are the sidepieces P, a photograph of which appears on page 67. An open door is cut in these pieces. Three strips are gived on; the top one, which follows the curve, is like the handrails, and the two lower ones are straight. Between the latter, pieces P are painted black with a gold aganthou pattern

into the bows of the buil, just under P, the hawse pipes are bored to take the anchor cables. For these I glued on 1/4 in. pleces of wood 16 by 16 in, and bored two 3/16-in. holes in each, pointing aft and up.

On the end of the brak deck is the figurehead U. This can properly be a dragon, grifan, or lion. We have chosen the former, as can be seen in one of the drawings above It is feet sawed to shape and then lightly carved with kinte and files. Finally it is glued and nailed down, but it is better to leave it off until the rigging is completed.

This is also true of the stern lanters V It is made to the size and shape shown. It is a six-sided block, with button molds above and below, and through all is passed a large headed pin. Panels (Continued on page 93)

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FINISHING THE HULL OF THE REVENGE

(Continued from page gs,

are cut in the flat sides, and in these are set silver paper and cellophane. These "glasses" are lined in black to represent panes. The lower end of the pin is set in a bole in the stern board.

The hatches W, shown in the drawings last month, are made as for the beak deck, but the gratings are set on a thin page of wood

painted black on top and sides.

The overlays e, g, h, f, also shown last month, can be applied at any time after the bulwarks are up. On my model the overlays are 1 to-in plywood, but cardboard would do. They are used merely because it is easier to get a neat finish this way than by energies and painting the bulkbeads themselves, of which they are supposed to be part. Doors and windows can be curved, with panels sunk in. The overlays are glued to the buikbrads

AT ABOUT this stage of the construction the mast horse should be bored through the decky. Start with small boler and enlarge them to come four with the slots cut is the centerboard. To bore for the bowsprit, which passes to starboard (right) of the foremast, ship a temporary foremost and then bore a 5 16-on, hole close to it and close to the deck on the starboard side at the correct angle and so that the forward end of the sprit will point aligh, y over toward the muulle line

The four knightheads, illustrated on page 59, can now be set in position. They were also shown in detail X last month. Each has sheave holes, or three cords in a love and att direction and an evelot tion one said The

catheads XX are quite similar

There are two ladders, one at Y as shown og the deck plan last month, the other going to the poop deck on the port side. They are most easily made of strips of wood, which should be a full 16 in, by a bare 1/16 in. The sides are cut to the right length with the ends at a slant, five or six notches are filed at the same slant loside each side, the steps are cut, all of exactly the same length, with sharp ends to fit in the notches, and the whole is glued together and held in position with long pine on a board.

THE eight gum that show are made as in detail & of wood, brass, or lead, with pins through them for trunnions. The gun entringes are cut with steps and notched down the middle to take the guns, which are held with a touch of glue and bent-pin staples. The guns can be made a shade less high and

have wheels, if you wish

The lower deck guns are the same size or a trifle larger, and need have only their outer ends shaped. The carriages may well be a bit larger. The guns are fastened to them with trunnions or merely held down by nailing through. The carriages are well glued underneath and passed through the gun ports and held down until the glue takes hold. See that they point level or slightly upwards and at a right angle to the bull.

The tiaging will be taken up in the third article, which will be published next month.

MICROSCOPE SLIDES PREPARED WITH GUM PATCHES

In motivities speciment for examination with a low-power microscope lens, I have used very satisfactorily cells made with gummed cloth stickers sold for reenforcing the holes in loose-leaf notebook sheets. Place the glue side down on the slide, set the specimen in the center, cover the rim of the cloth patch with Canada balsam, and add the round cover glass. This method is much easier than buildang up a cell with sheller,-T G. Herrick.



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PRESERVING SPECIMENS FOR YOUR MICROSCOPE

Continued from page 30,

happen that we want to peer into the inside of specimens and learn the structure of their internal parts. This curiosity is especially keen in regard to the stems of plants and flowers. Cross sections will reveal their wonderful and intricate layers of cells and delicate connecting Dispués

It is obvious that very thin stices of the stems must be cut off in the preparation of such specimens. Indeed, they must be so thin that light will pass through them. To cut slices as thin as this is no small task although from stems that are not easily crushed, slices may be cut with an ordinary safety rator bade. The cutting is done under a reading or magnifying glass and the slices are made as thin as is humanly possible.

N A more professional method of cutt ng The shore, an instrument known as a microtome is used. In our next article we shall not only learn to use such an instrument but we shall also be told how one may be made at home with a few simple tools and materials

The beginner should not become too ambillous in his efforts to mount specimens. If, for instance, he attempts the mountier of any live specimen containing viscera, he is sure to make a botch of it. Our next article will deal with this difficult subject and will tell you exactly how such specimens are mounted so you can make them for yourself

In catalogue and filing our microscopic allium, we shall need a few more simple accessories. Cataloging really should be done as it gives a nice professional touch and makes your collection ready for instabl use

A stacket, bearing the name of the specimenand the filing date, is pasted on each completed slide. Such stickers may be bought at any stationery store. On the end of the box in which the slules are filed is pasted a slip of paper on which is written the names of the sames it contains. Each box is numbered and reserved for a distinct subject

While such filing boxes may be had at a triffing cost, it is fun to make them. If a doten or more are made at a time, they will cost you very little in labor or cash

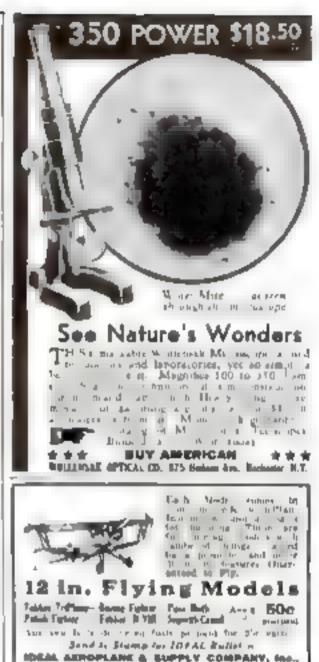
Soft pine is used for the body of the boxes The little comb-shaped pieces between which the sildes are slipped may be cut by mounting logether two carcular saws of the same diam eter and arranging the law table so that a cut halfway through the stock will be made In this way, these pieces may be run through with lightning speed. They are fastened to the sides of the box with curpenter's glue.

F A dozen boxes are made at once twentyfour ends and slade pieces are put through at a time. As plywood is a little thick for the tops and bottoms of these boxes, a better material to use it rigar box wood.

After each box is finished, by nailing it. together with small brads, a long strip of paper numbered from one to twenty-five, is glued to the bottom in such a way that slide number twenty will be directly above the number twenty on the paper. This makes it easy to find any desired slide

FORESTS IN U. S. SHOW A BIG INCREASE

Antigeran forests have staged a 33,000,-000-acre comeback since 1920, according to the latest reports of the U.S. Forest Service This gain in wooded land represents more than a six percent increase in twelve years The total area now occupied by commer cial-forest tracts is put at nearly five bun dred million acres. Three-eighths of this bears trees large enough for saw wood, one-tourth hears timber of cord-wood size. Scrub and brush cover the rest.



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Making a Stitched Harness Splice

By L. M. ROEHL

New York State College of Agraculture

IN REPAIRING harness on a farm, it is often necessary to make a statched splice. The tools needed are a kmie (preferably round as illustrated), a finishing wheel, a marking wheel, a sewing awl, a clamp, waxed and needed harness thread, and a clamp How to prepare the thread was told in a previous article (P. S. M., April '33, p. 99) t. Cut ends of straps square as shown at A.

MARKING WHEEL TRIMMING

How the reds of the arraps are skived, and Brope in entricking and tramming the option

2. Skive off or taper the ends on the flesh or rough side of each piece for about 15% en, as at B

3 Lap the strain about 2 in, and mark off the stitches the full length of the splice as

4. Place the spice in the clamp with the marked side and the end nearest you facing right and the marks close to the jaws of the clamp as at D. Make the first hole in the single strap farthest away from you (beyond the splice) Place the thread in the hole and draw the ends even. The awl is kept in the right hand. Make the second hole and place the jeft needle in it and draw it about I ft through with the thumb and index finger of

the right hand. With the awi and both needlesin the right hand, pass the right hand needle through the hole, draw it through with the left hand, and pull the stitch up tight as at E. Continue this until the last stitch has been made through the two straps

5. Make one hole beyond the splice and pass the right needle through. Remove the work from the clamp, cross the threads, replace the work in the clamp end for end with the other edge up, and continue the staching

6. Finish the statching by placing the left needle and thread in the last hole, which is beyond the spice, then, when the right needle is in the hole, the left thread is wound twice around the right needle, and the threads are drawn tight. This ties and locks the thread

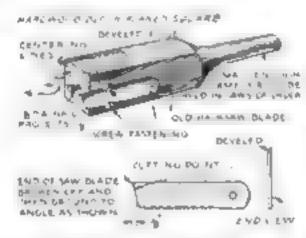
7. The right thread is then passed through another small hole about 36 in, below the next to the last street, and the threads are cut off close to the strap

il. The stitching is then smoothed down with the finishing wheel, and the edges are trimmed smooth with an edging tool or knife

IMPROVISED TOOL CUTS HOLES IN THIN METAL

"HIS improvised tool will cut circular boles through any comparatively soft metal up to 16 in thick without marring the surface, even if painted or Jacquered. It will also cut through pieces of thin gage without bearing them

If a 1-sh, bole is required, for example plane a stick of hardwood I in square, cet it off about 4 in long, and round one end so that it can be gripped in the jawa of a brace



The assembled tool and a diswing of one of the catting blades to show how I is ground

Mark the square end of the piece with Goig ona, cross lines and who e they meet hore a with hoje 1 in deep. Do ca heade nainto the being allowing it to project amount a on Now bott, an ow back saw brade and break off a piece from each end, including the eye, appeaximately 13/2 in. long. Grind each as shown and fasten them with short roundhead screws to two opposite sides of the block. Smaller acreus driven beside each blade will prevent side motion

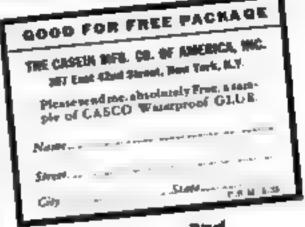
Drill a 50 in guide hole in the metal, slipthe nail into thes. and turn the brace until the cut has gone half through then cut from the other side.-] ANDERSON

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An opprant gooseneck lamp placed close to the surface of the water in a tropical fish aquarium will supply the extra best needed to maintain the proper temperature in the spring and fall when the fornace is out of service. By moving the bulb to or from the aquarium, the heat may be regulated so that just the right amount is radiated at all times.- KENNIH M. WELLAMS.

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FROM CHEMISTRY COURSE TO OWN FACTORY



READERS of should find the fullowing story of unusual interest, because it deals with success on a small but perfect scale. In times like these nothing can be more heartening than to learn that

young men can and do find ways of making money by methods somewhat off the bea en teacle

James Cogswell, of Pasadena, attends a local military academy and, because of circumstances, finds it necessary to puy for his own way. He is operating a small homemade and home-financed chemical plant. The Government will never get rich on the income tax returns from this business, but James Cogswell is making enough to pay for his tintion, buy his clothes, books, board and food

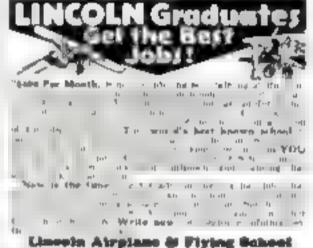
The product he makes in this plant is lampblack, and the process involved came cirectly as a result of his chemistry studtes and experiments. Here, in itself is an example of the practical application of knowledge and study to the business of a along a living. It was the application of but work in chemistry, coupled with actual poinstaking laboratory experiments, that led to the installation of equipment that sutomatically converts onlineey crude fuel oil into a high grade of lampblack generally specified and used by contractors

This is the way it is done. The crude oil is burned in a steel drum with valve mets that control the amount of air fed to the flower. From this incomplete combustion process is obtained a thick, heavy black smoke, laden with carbon particles (lampblack) By means of a small, homemade suction fan the heavy smoke is drawn off and led into a series of settling chambers, so built that the lampblack will collect along the bottom of the chamber while the gases pass through and are allowed to escape

PHIS lampblack is then packaged in one and five pound paper sacks. Cogswell has found a ready market for it among cement contractors, who use it to soften the glare of the otherwise pure white finish of cement used in road and sidewalk construction. Another popular use of lampblack is in coloring mortar in brick work.

The equipment used by Cogswell with the exception of a small motor, is entirely home made. And while it is not a model of efficiency it does its tob well, converting a raw crude oil worth 65c into about \$3.50 worth of / Continued on page 97 ,

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Secrets of Success

FROM CHEMISTRY COURSE TO OWN FACTORY

(Continued from page 96)

saleable lamphlack.

Cogswell takes advantage of the fact that he has no classes to attend on Saturday morning and delivers his product to his customers on that day Distribution problems are rather simple, as two bard ware stores and a building material supply company are taking up his entire output at present

This small busi-ess of Cogswell's not only supplies him with a living, while still attending school, but also it will serve to give him a footbold on the business ladder when his school days are over and he must find some permanent full-time tareer. For he is certain that he can expand its present limits by devoting more time to it than he can now.—E. J. V., San Marino, Calif

BECAME A SUCCESSFUL RADIO MARINE OPERATOR



FOR a great number of years after les ving school, my "career was conspictions in its lack of distinction, to say nothing of success Mostly, I worked as a day laborer in all kinds of factories. I took my

job that was to be had, as I was always op against the need of getting work immediately after leaving the last place.

My education was very limited, as I had not even finished grammar school, It was with great envy that I looked through the achool advertising in various magazines—especially those advertising professional trades. To me it seemed necessary to have at least a high school education to enter one of these trade schools Incidently, even today a great number of fellows read these advertisements and turn away with this same, self-crected barrier in their minds

After knocking around for a longer time than was good for me, and working at odd jobs here and there, I decided to take up a radio course in one of the schools whose advertisements used to fascinate me every time I opened a magazine. Fortunately, the school happened to be located in the city where I lived, and so I kept working during the day and attended classes at at night. After completing the course, I took my examination before the Local Radio Inspector and passed, receiving my license. Then things began to bappen.

A short while after putting in my application for a posi- (Continued on page 98)

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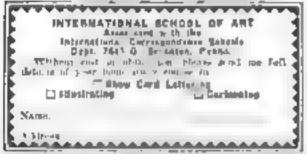
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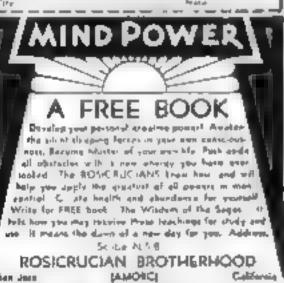
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BECAME A SUCCESSFUL RADIO MARINE OPERATOR

(Continued from page 97)

term. I was engaged and sent out as a Radio Operator on a passenger vessel sailing for the West Indies Since that first job, which seemed like a to le glimpse of beaven to me, I have sailed all over the world, touching ports I never dreamed existed. To say there is no comparison between this work and the work I did before taking up the school course in to make on under-statement!

I now have a profession that I can be and am proud of, and my work is a rudy, year in and year out. Not only is the may good, but all my traveling and mang expenses on duly are paid for. There s no such think as a dull moment in this work. and I have that feeling of sa miaction about my job that makes it the aggest success a man can wan!

I the man with no special training. and with a bunkering for something beiter in ale to say that this is the time to take another look at that advertisement he has seen from time to time. I suggest writing for particulars and shaping a course for improving his future career. When these dull times are over. the demand for well-trained men in every and will be greater than ever. Take advantage of the full now and be prepared for the boom that will come later. As for radio, to me its opportunues seemed limitless. As it has been up till now, with the trained men getting the best breaks, it will continue to be in the new fields that will be opened in the future.--H. R. Wallin, Brooklyn, N. Y.

Cash Prizes

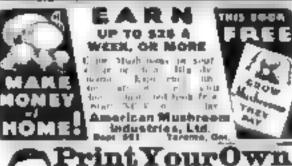
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NO JOB TOO TOUGH FOR MINUTE-MEN COPS

(Continued from page 32)

wreckage, by the night watchman, a heavy boiler pressing upon his crushed leg. But his grouns proved he lived. Toward ham, through the mass of wreckage, three policemen twoneled with tools from their green truck, At their heels erept Sergrant Michaels, with emergency kit, ready to ampulate the victim's leg if need be to get him our

Ambulance surgeons would not go into the tunnel for firemen warned that it would cave in. Almost it did, but not quite. The men in blue worked frantically, and at last, in triumph, they brought out the watchman-

his leg neatly bandaged

From tragic to amusing rescues is a transition the squads make every day. They play Providence to drunken men, boys and animals One of the first, they salvaged from atop a wooden pile where he was marooned in the East River, forty feet from thore. Supposedly, he had crawled there from a passing boat, be couldn't remember

THE noisiest of all the squads' many animal rescues, was when they lassued a brown bear. He had strayed from a pet-shop into a tenement house. The bear mared and the occupants acreamed. Another time 5 good Fourteen threw a rope around a 5-0-00 strate bull that had jumped off a carrie boat lawfed at Coney Island, and chased the bathers When lassoed, he was completing an eighteenmile swim in the Loper Say. A cal's meonhas summoned many a policeman to risk life in an effort to retrieve a pet from a situation where, nove or dead, it threatened to be a public nutsance. Policemen have been lowered by ropes attached to fifebolts, from the roofs of tall buildings, to save cats from copings, they have used their knowledge of high-tension wires to climbung telegraph poles for the same purpose

But such ordinary triffes cause only a fruction of the calls on which the green trucks roll. They have played a part in coping with all the great emergencies of recent months in New York. Last summer, an ammonta pipe-line in a refrigerating plant burst in the crowded lower East Side. Over eight blocks of tenements spread a minima of choking fumen. Hundreds were gused, they lay in narrow ballways or staircases, on pavements or sidewalks where they had fallen. It was the emergency crews who revived them, and

calmed the panic-stricken crowds

Ten trucks rushed to Concy Island to handle a crisis caused by the \$2,000,000 fire of last July. Here were 200,000 people, many with nothing but bathing suits, penniless, refugees in fog and smoke, miling about, some bring overcome, some looting. Calming those people and getting them started home was the work of the green truck crews,

O'E of the most formidable offensive tasks the emergency squads have had, was the recent revolt of 1,600 prisoners on Welfare Island in the East River. One was killed before the first police got there. An emergency truck reached the scene in three minutes, a battleship on wheels, with its full armament or rifles, shotgues, machine-gues, lett-gas and smoke grenades, and even bullet-proof vests and steel helmets for the crew. They waded rate the milling criminals and soon had them under control.

Thus night and day, the green trucks roll in answer to the cells from the restless life of the great city. When they go out, they are prepared for any emergency. It may be a riot in Union Square, a helpiese child chinging to a window ledge, an explosion in Wall Street, a mad dog scare in the tenement district, the body of a suicide on the roof of an annex. Whatever it is, they never hesitate.



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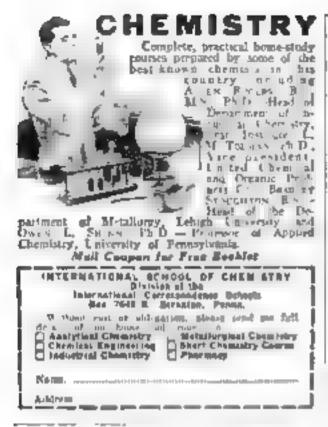
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NEW ARMY DRILL TURNS ROOKIE INTO SOLDIER

(Continued from page 15

Coder the new Regulations, this column of threes is the standard intanter column formation replaces, the time behind too time of four:

Forward march. The county repped out bricks. Cotumn racht march. The right flank man of the leading rank faced to the right in marching, and took up a half step. The other men in his rank, without changing their intervals, circled to the right until they were abreast of the pivot man. Then they all stepped out in the new direction. The other ranks turned on the same ground, in the same manner.

"Form line to the right, sergeant," or-

deted the captain

"Column right, march" marked the sergrant The column changed direction, "Section, half" Left face!" And the section was back in its original triple-ranked formation.

TWO rife sections form a rife platoon, rommanded by a licutenant, with a platoon terrecant at second in command. The sections are formed in their normal three-rank formation, with a three-page interval between the sections

To increase the platoon column to a front of six men, the command "Platoon mass right" was given. The leading section stood fast. The rest section executed "column half lett and halted when its front rank was on line when front rank of the leading section. This formation is used mostly for passing in re-

A rifle company at war strength is composed of three platoons and a company headquarters. Under the new Regulations the company is not considered a close-order drill unit. For it only such formations are prescribed as are necessary for ceremonies and marches. Most impressive of these formations is the company mass, which, with the company at full strength, gives it a front of eighteets men and a depth of eight ranks

Prepared by a board of officers under the direction of General Puqua. Chief of Infantry, the new Infantry Drill Regulations still are tentative, and are being given a thorough test by various units of the grmy Undoubtedly, when reports on them come in, some changes will be made. But it is fairly certain that they will be adopted as the training bible of the modern doughboy

If THE United States gets in another war it is probable that we will again face the problem of raising and training a large arms in a short time. Every one of the many officers I talked with about the new Regulations agreed that they would be of great value is training raw troops in such an emergency But those officers did not agree that troops trained under the new Regulations would be as good as those trained according to the old

The fundamental difference between the old and new Regulations is the difference in their chief purpose. The chief purpose of the new Regulations is queckly to train troops so that they can be moved from place to place, and sent into listtle. The thief purpose of the old drill was to discipline men, to incultate on the purade ground a subconscious obedience to orders so strong that on the hattlefield it insured obedience even when obedience means death. Even the mosterthistastic believers in the more-modern system admit that it lacks the disciplinary value of the old drill.

Though performed smartly by Captain Shoemaker's company of Twelfth Intantry Regulars, the new drill lacked the sext and impressive precision of the old. Performed by less perfectly drilled men, it could, I think, easily degenerate into downright sloppiness. Enlisted men, like their officers, believe in its value for emergency training, but many of them regard it as too easy (or professional soldiers.

A NOTHER objection made to the new Regulations is that the column of threes will lengthen the aready long column of an infantry division, and make it very difficult for the divisional commander to get enough troops in action in a merting engagement to insure success before nightin

Standing firm against all these objections, however, is the ale-important fact that the new draws easily and quickly learned?

Every important improvement in the weapoins of war forces a change in infantry tactics and formations, and sooner or later, these tactics changes are reflected in the Regularious life are the World War the American infantryman fought with just two weapons—rifle and bayonel

If an American Injuntry regiment went into battle today it would fight with no less than ten weapons—tanks, 57-mm guns, light howitzers, marbine guns, rifle grenades, automatic rifles, rifles, hand grenades, pistols,

and bayonets.

The wartime Tank Corps has been washed out and the tank now is an injustry weapon, operated by specially-trained injustrymen.

The infantry remment of laday, with a war strength of 3,100 and a peace strength of 1,217 men, consists of a regimental head-quarters company, a service company, a huwitzer company, and three buttalions. Each battalion consists of a headquarters company, a machine gun company, and three rifle companies. The howitzer company is organised in three platoons, each platoon operating a light howitzer and a 37-mm, gun, and in action one platoon is attached to each battalion. Animal transporation is used freely, and many a doughboy has to be an expert in some activity, such as riding, driving a learn, or mule leading.

OPINIONS vary as to the desirability of the new Regulations for close-order dril, but every army officer I talked with thought them just the thing for extendedorder drill to teach the mechanism of actual fichting

The squad column, with the squad leader at its head, in the basic unit of the new axtended-order drill Squad and section leaders, corporals and sergeants, are made more important by the new Regulations

When the command "As skirmshem" was given the men of each squad deployed in an irregular wedge, with intervals of about five paces between men. Anything even resembing a straight line was avoided. Then the squads advanced by infiltration—small groups, with the automatic referren among the first to go, working themselves through pape in the supposed enemy's fire

Then the rifle section advanced in a line of aquads covering an average front of 150 yards. This was varied by a triangular formation, in which the croter equad was either

forward or back

Something new to me was the appearant formation A section was in column of threes when its leader shouled, "Airplane" The outside squads sprinted to either aide of the road, and formed irregular semi-circles. The men of the center squad jumped into ditches on either aide of the road. The result was a scattered group of soldiers who would make a poor target for an airplane machine guntaer or bomber

Yes, the doughboys have gone modern!

BLINDING HEADLIGHTS DOOMED BY TESTS

Continued on page 37

other hand, are used to light up the foreground. Piece by piece, the headlight beam is built up by selecting tiny firament images and bending and guiding them by the proper lens thickness

The one-eyed car is a familiar pest whereever there are roads. Often the driver does not know that one of his headinghts is out For this reason, lighting engineers recommend the use of small metal reflectors on the top of each lamp, These catch a small amount of the "ght and direct it back to the driver as a tentale Often a curved rod of glass or quartais used for the same purpose

Al THOUGH there is little that the motor-ist can do about the other fellow's oneeyed car, he can protect himself by carrying a supply of boths and using them the minute he finds that one of his own headlights has reased to function

Bulb harns-out, it is found, occur most frequently during the winter. This may result from the high voltage caused by an effort to increase the charging rate to overcome increased battery drain or by the higher resistance of the storage battery when it is cold. Also, an unlighted filament, especially an old one, is more brittle in cold weather and may enup with the vibration.

Even though the headaghts are the real eyes of the motor car traveling dark roads, they are by no means the only important piece of lighting equipment. Tail and stop lightly are also essential for safety. An increasing number of cars are being equipped with two stop lights. In addition to being more prominent, they serve to mark the boundaries of the car

When two stop lights are used, they can he wired to serve as turn indicators. Flashers operated thermostatically or by pendulums or similar means are connected into each stop hight circuit. When the driver wants to turn left, he presses a buston and the left stop light blinks on and off rapully. For a righthand turn, the right stop light serves as the signal. Both lights operate steadily when the brakes are applied

This system has been found to be simple and is superior to most of the other direction indicating schemes that have been propased. The device controlling the signals should be semi-automatic in operation to that it will switch off when the turn has been made and prevent misunderstanding on the part of other drivers on the road.

Countless tests, made in dense fors on dark roads, have shown the way to better driving in the fug. Best results are obtained when a spot or driving light placed in front of the car and close to the road, is used. Lake smoke, for is less dense close to the surface of the ground.

FRONT compartment lights, step lights, trouble lamps on wired reels, and dooroperated dome light pwitches are useful accessories for the modern passenger the and their use is becoming general

Fender lights that turn on automatically when the headdight beams are depressed are an added safety feature. Besides serving as boundary lights in driving and parking, they act as pilots to tell the driver that his pass-

ing lights are on.

While the motorist can do much in the way of improving his lighting system mechanically, he can do the most by following the sample rules of road courtesy. If the light domming habit were universal and headlight adjustment compulsory, lawmakers mucht permit the use of more powerful lights. Until then, many automobile lighting improvements must remain laboratory currosities.

Small Ideas May Have Large Commercial Possibilities

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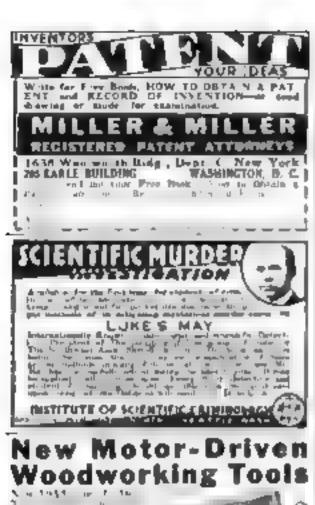
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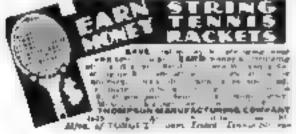






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OPERATIONS ON HUMAN BRAIN

(Continued from Joge 26

original operation consists in removing the top of the skull and replacing the bone with a heavy plate of special celluloid. This somewhat changes the shape of the skull and eliminates the pull at the attached points. The staip grows over the plate and fibers of the dura, granting through tiny holes in the thick celluloid, anchor it firmly in place. To date, Dr. Ney has performed this operation upon seventy-four epileptic patients, with remark able results.

AT ONE point on the brain, a speck the size of a probe of produces absenue, symptoms, at another point, a tumor becomes as big as a list before it gives senous trouble

A few years ago, a young tennis player of my acquaintance began having trouble with his serve. He couldn't seem to throw the ball into the air twice alike. That was the only thing he noticed along with himself, he told me when he came for an examination. Yet study of his case revealed that the cause of his trouble was a tumor on the brain about the size of a hazelout and almost as hard

When it was removed, the player's diffitulty disappeared. If the tumor had not been discovered in this unusual manner, it might have grown to a size that would have made its removal most difficult, or even imposable. Surgeons today are more than ever on the alert to discover and remove such tumors as early as possible

Not many years upo, an obscent of the brain was considered hopeless. Even when an operation was performed, at least eights five per cost of the patients died, Today, improved methods and eartier diagnosts sa the lives of an increasing number of such sufferers. There have been cases in which an abscent of the brain has been cured simply by tapping through the skull

An instance of this kind occurred in Cleveland, Ohio, three years ago. A sex-very-old loop was running down the street when be fell and the point of an umbrella punctured his skull. Infection, carried into the brain, developed in a an absence

By defiring a small hole through the skull over the intected spot. De Albert T Steermann, the surgeon in charge tosened a bollow needle attached to a syringe and drew off an auace of pur. Immediately the hos began to corprove. On alternate days, this tapping was reneated used no more pur could be down off As a result the child made a complete and permanent recovers

Approximately ten per cent of all cases of meanity arow out of injuries to the head. It has been proved, in a number of instances, that normal persons have been turned into criminals as a result of a blow that injured the brain. Curiously enough the most serious symptoms of brain injuries often tail to appear until weeks after an accident.

FOR instance, take the queer case of a wandering bullet found in the brain of a negro bricklayer. A few days before he was rushed to a hospital, after being shot through the back of the skull, a fire had destroyed all the X-ray equipment. It was impossible to find the lead and the surgeons dated not operate without knowing exactly where they would find the bullet.

la spite of the fact that the mosile was left within his skull, the negro apparently recovered and left the bospital. Seven weeks later, however, he began to go blind. An X-ray picture showed that the bullet had wantiered from the course it had taken on entering the skull and had been carried to the center of vision at the back of the head.

It was removed and the patient regulard his sight.

At the last meeting of the American College of Surgeous, Sir William L de Courcy Wheeler, famous Irish auraeon, told of removing a builet that had been in a patient's brain for four years. The lead had lodged in the association area impairing the victure memory, vision, and hearing, all of which were restored by the operation

In another case, seventeen years passed before the aerious results of an accident became apparent A finding brick tractured the skull of an eleven month-old buby boy Convulsions followed for a time, then passed away At the age of seventeen, the boy began to have epileptic fits

THRULGH an areazing plees of surgery in which part of the boy's thigh was transplanted to act as a cushton for his brain. Dr Charles H Harris, of Fort Worth, Texas, restored him to health

tie found the fits were raused by pressure of the fractured skull-bone on the brain. Making a honeshoe-shaped incision, nine aches long, which extended from just bebind the left our around the back of the bond, he bited the section of the skull which was causing the trouble. Under it to not as a cushom and eliminate the pressure he placed a strip of fatty membrane cut from the patient's thigh

The core tion was a remake are so. The convulsions disappeared and the buy returned to school. Another dramatic feat had been added to the long list recorded in the annuly of brain surgery.

SEEK DEEP-SFA FISH WITH FIVE-MILE LINES

Write fishiance five miles long and colored tuchts for built, members of the Johnson-Smithionian deep-sea expedition are angless, in the Puerto Rican deep, a five-mile hole to the ocean floor north of the Island of Poerto Roco, for strange forms of sea life never seen by human eves, Bondes the lightbaited lines, they will lower to great depths, a trup, twenty-five feet in diameter and made of fron pipe and wire netting, which will have lour compartments, each with a differentcolored light for built. The fish which live in the total darkness and under the termendous pressure of great depths carry phosphorocept. lights of their own and are believed to signal to one another by means of them. Another study that will be carried on by the expedition will be an investigation of the ocean Soor in the deep. Six-foot cores are to be bored out of the seabottom by rocars of a special apparatus in order to determine the composition of the ocean floor at this point.

AMERICAN COW GIVES FARMER BIG INCOME

In 1932, the cow was queen of the American farm. Dairy products, a recent bulletin of the U.S. Department of Agriculture reports, for the first time led all types of agricultural fucome. Cotton, wheat, and live stock at various times in the post have been greatest revenue-bringers to farmers. Last year, milk and other dairy products accounted for \$1, 180,000,000 of the total farm income, with live stock ranking second with a record of \$1, 1, 200 of the income from the 1939 figure, and the ancome from grain fell off seventy per cent.



CHART OF AMERICAN TRUCK TYPES

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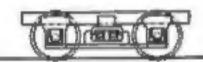


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SCALE IN FEET

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Railway car trucks draws to scale for those spodel makers who hold their own equipment

CHART AIDS IN BUILDING MODEL CAR TRUCKS

MODEL railway engineers who are interested in the construction of tolling stock will find the accompanying chart of assistance. It shows the standard American truck types in "0" gage and No. 1 gage, drawn accurately to scale. Constructors who require the exact scale—that is, those who wish the parts shown full size—can have the chart photostated up to the actual size required and then use the chosen diagram as a template in making the trucks. This will save redrawing.

Diamond frame trucks are the simplest to make. Strips are made out and then bent to the gage sizes, and the necessary holes are drilled for clamping the parts together where they are to be soldered. The wheels can be made by the simple method of spissing described on page 87.—J. G. M.

LONGER LIFE FOR YOUR CAR VALVES

(Continued from page 58)

serviced now and then. Trouble is, most car owners don't think of the valves until something happens. If you grind your valves every time you scrape carbon, they'll last just as long as any other small moving part.

"The important thing is to be sare that the valves always close tightly against the seats. If they do, they'll be cooled off between explosions and won't born so easily. That's why a weak valve spring is just as bad as a poorly ground valve—the valve doesn't close tightly."

"I never thought about the valve springs," Chet admitted. "How do you know whether a spring is weak?"

"By the length," Gus told him. "If one spring is shorter than the rest, it'll be weaker than the rest. Of course, you can tell for sure by rigging up an ordinary weighing scale like an iceman uses so it'll measure the tension of the spring when it's compressed."

"Gosb, this valve business is kind of complicated," exclaimed Chet. "I thought valve grinding was one of the jobs any car owner could do."

"Valve grinding's easy," Gus assured him, "if you'll take enough time to do the job right. Remember though, too much grinding is worse than none at all."

"That's O. K., but how do you know when the job is finished?" Harmon inquired. "I ground those valves a lot just to be on the safe side."

"Ever bear of Prussian blue?" Gus asked as he reached for a small can on the sepair bench. "It's the stuff machinists use to test a fit. Smear a little on the valve face, press it down on the seat, and give it a twist. If the valve's a good fit, the blue will be smeared off in a circle around the face. And if you haven't Prussian blue, mark six or eight pencil lines across the valve face."

"I suppose the wider you can make the valve seat the better it is," Chet interrupted.

"Nope, you're wrong there. The best kind of a valve seat is a fine, narrow edge. It'll last longer than a wide one and won't offer so much surface to collect carbon particles that may keep the valve from closing.

"Speaking of carbon, there's one point the amateur mechanic always seems to forget when he is refinishing valves—the valve stems. Be sure they're clean and free from crusted carbon before you put them back. A square of number zero or zero-zero exacty cloth will polish them up in fine style."

"Say, Gus," Harmon said, "why don't automotive engineers figure out some way to make the valve mechanism on a car safe and sane? They ought to be able to heat the overheating and warping trouble."

"They have in a way," Gus replied. "Some of the new 1933 models have special steel ring inserts for the exhaust valve seats and they're using alloy steel valves that stand up better under the heat. There's one hitch, though. Some of the new alloy steel valves are so hard they're not affected to any great extent by ordinary valve grinding tompounds. If they're in bad shape they have to be reconditioned on a regular grinder and then lapped with compound."

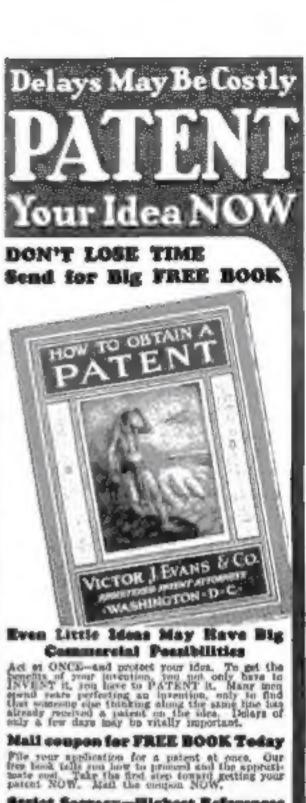
"Well," sighed Chet as Gus passed, "I guess I'm booked. Fix my cat up and phone me

when it's ready,"
"O. K., boy," nodded Gus. "Want me to
do the job right and put in new valvesprings?"

"Give it the works," Chet told him. "Put in anything that'll make it run again. Put in some valves and valve seats that'll never wear out, if you can."

wear out, if you can."

Gus smiled. "That's an order I'm airaid no one can fill—yet."



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Blake, server and and

Scientists Unite in War on Earthquakes

(Continued from page 13)

has taken on a new and urgent importance. Data assembled through laboratory tests will be combined with study of structures destroyed by the California shocks to answer the question: What kind of a building is best fitted to survive an earthquake? This

is the problem scientists at the Massachusetts Institute of Technology and the two California institutions have been trying to solve by means of elaborate tests,

On platforms mounted on steel spring columns, tiny reproductions of buildings are being subjected to miniature quakes which are expected to reveal the weaknesses of present construction and the requirements of

quake-proof structures.

At Stanford University, a heavy metal wheel, swinging like a pendulum, periodically strikes the platform in imitation of the shock of slipping rock strata. Other inboratories use heavy, off-center fly wheels to shake the testing floors. In the earthquake room at the California Institute of Technology, I saw several kinds of buildings, reproduced in miniature, dance and vibrate in the grip of mechanical quakes while deli-rate instruments recorded the minute stresses

and strains of the tiny buildings. One of these complicated testing mech-

anisms looked like a cross between a stockticker and a large mechanical toy. It con-sisted of a small electric motor, a little model of a six-story building, four strips of paper, four electric coils, and a queer irregular-edged board. Professor R. R. Martel, in charge of the experiments, started the electric motor. It drew the paper strips post tiny metal points at each floor of the miniature building. Then he inserted the board in a riot at the base of the testing machine. Its wavy line represented the vibrations of an earthquake and produced pulsations that shook the little structure.

Instantly there was a sound like the buzzing of a thousand infuriated bees. It was produced by sparks Jumping between the high-tension points. Professor Martel explained that these sparks punch holes in the paper. The pattern formed on the moving strips by these holes shows graphically the movement of the various parts of the building and indicate the stresses the laboratory

quakes produce,

With such models, scientists are verifying mathematical formulas that will aid architects to build sounder structures in earthquake regions. New formulas may be possible when the data collected by the government heavy-duty seismographs have been made available for use in the calculations. Heretofore the motions of the laboratory quakes have been admittedly only an approximation of the vibrations result on from

real tremors. Moving beams of light, recording on white ribbons of sensitive paper the movements of the earth during the Califormia shocks, experts bope will enable them to discover a trend that reveals the general characteristics of all earthquakes.

A special phase of the researches in the laboratories concerns vibrations set up in buildings by earth tremors, If a building gets in tone with the earthquake vibrations, it will crumble, just as a bridge will collapse if an army marches across it in step. But does the earthquake stay is tune once the

Mysterious Under Sun



O NLY lucky aviators and mountain nomenon of the Under Sun, pictured in this striking photograph. It occurs when the sun is reflected from clouds formed of tiny ice partitles. To see it the observer must be above such clouds. This photo, taken from the highest peak in the Bavarion Alpa, shows the nature of the image

ground begins its tremors? The seismograph records will be studied to find out. At the California Institute of Technology, special tests with cross-bracing have been carried on with model buildings to discover ways of overcoming earthquake vibrations in various types of large structures.

Other experiments are under way to discover not only how elastic a building must be to withstand the earth's movements in three directions but also how rigid it must he to pull itself quickly back into shape,

The worst type of building for an earth-quake zone, according to the famous Amer-ican architect, Frank Lloyd Wright, is one with a steel framework, curtain walls of masonry and floors built into them for support. A structure with a low center of grayity, shallow foundation and a light roof, he says, has the best chance of surviving the shocks of an earthquake. One of the buildings designed by Wright is the Imperial Hotel at Tokyo, Japan. It was one of the few structures that withstood the quake of 1923.

Will we ever be able to predict the coming of earthquakes as we now predict-storms? Many scientists believe we will. As the tremore are caused by straining of the earth's crust, we may be able to watch the progress of strain in the surface rocks and thus learn when and where the crust will snap. Plans for measuring such strain us it accumulates with the passing of time are now being

Another line of research concerns the influence of the weather and electrical phenomena upon earthquakes. Some scientists believe that the changing pressure of the air upon different parts of the globe is the natural phenomenon that sets off the quake.

In the summer of 1925, when the Santa Barbara tremors occurred in California and shocks were felt in other parts of the United States, it was noted that the weather was remarkable for its humidity, high barometric pressures, and its frequent thunderstorms. Electrical disturbances originating (ar down in the curth's interior are thought by many geologists to cuntrul the snapping of the earth's crust. Such disturbances, accompanied by marked climatic changes, occur in violent outbursts that come in ten or twelve year cycles. Sun spots are also linked to earthquakes by many scientists.

A world-wide chain of observation depots for the collection of weather and electrical data, which can be compared with astronomical and reismological facts collected by other observatories, would be of infinite value in increasing our understanding of quakes.

Only in recent years has there been anything like systematic, scientific observation of these trembings of the earth. Before earthquakes can be conquered, they must be understood. In the wide-spread attack upon the mysteries in connection with them, which has been stimulated by the recent disaster in California scientists hope to go far in pretecting mankind from their menace.

How to Tell Time by the Stars

(Continued from page 47)

observer knows that the clock has lost a tenth of a second. He accordingly regulates it to run slightly faster, and applies the correc-tion to the time signals sent out by radio and telegraph.

This operation does not require the eighnrate senith telescope of an observatory. You will find it interesting to check the accuracy of your watch yourself by observing the arrival of some star at a certain point each evening for two or three days running. A star pear the celestial equator is the best to take. In other words, a star that crosses the sky somewhere near the overhead point. You should not, however, try to observe it at the zenith or meridian as the astronomer does-Instead, wait until the star disappears behind a tall building or hill on its way down the western sky.

To note the time of the star's disappearance as accurately as possible, you should establish some sort of a backsight. A pin stuck into a window such will do. The young man in the pirture on page 51 is mine the point of a triangle of cardboard fastened to the sash. He keeps the chosen star at the point of the triangle, and, watch in hand, notes that the star vanishes behind the building at twenty-one minutes after nine. The next night it should disappear at seventreet minutes and four seconds after nineif his watch is correctly regulated.

But he finds that the star goes out of sight at seventeen minutes and fourteen seconds after nine. He therefore knows that his watch is running ten seconds fast in twenty our bours. He pushes the regulator a little way toward slow, and awaits the next evening's

observation of the star to see whether his adjustment of the watch's regulator has put it in harmony with the star.

A word of caution is needed in connection ith this watch regulating experiment, Be sure that the star you select to use is not a planet. If you should unknowingly time the disappearance of Venus, Mars, Jupiter or Salura, the amount that the planet moves in its orbit during twenty-four hours would spoil the accuracy of your whole observation and upset your time calculation so you could not regulate your watch,

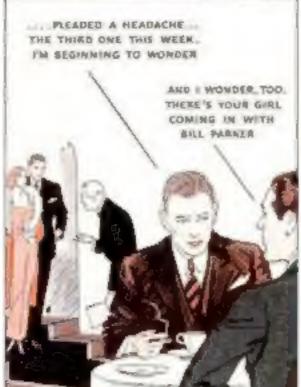
The next article will show how to use the sixteen stars you have marked in your umbrella sky in finding the principal star groups in view at the season, and how to construct a new kind of revolving star map that will be good in any mouth of the year.

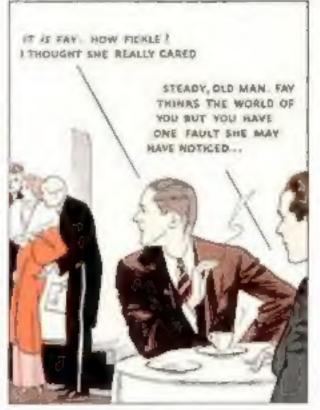
WHY FAY WAS FICKLE_



by Timbins











You can't be too careful about "B.O."

ON'T FOOL yourself about such a serious matter. You cannot afford to take chances with "B.O." (budy order) at any time of year. Every day-rain or shine, warm or cool-pores give off at least a quart of odoe-causing waste. Buthe regularly with Lifebuoy. It is so different from ordinary toilet soaps that it's in a class by itself. Lifebooy's clean, refreshing, quicklyvanishing scent is your assurance of exten protection. Its creamy, hygienic lather purifies and deodorizes pores - stops "B.O." Helps protect health, too, by removing germs from hands.

For a beautiful skin

Cleanse your face thoroughly every night with Lifebuoy's bland, pore-purifying lather. Millions follow this simple plan. And their complexions fairly sparkle and glow with radiant health and clearness.











THY IT'S SEE IZ-DAY LIFEBUOY

How to get smooth, long-lasting shaves

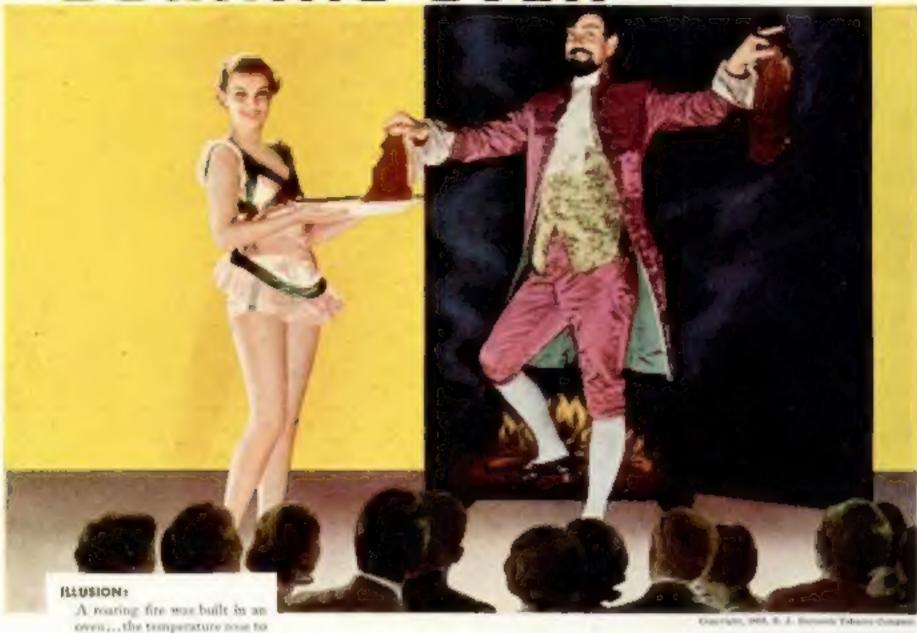
This extra-moist lather wills tough beards - soothes the skin

HERE'S NO tock to getting a clean, lasting shave if you use the right lather. Light, bubbly, quickdrying lather won t do. But Lifebuoy Shaving Cream lather bolds 52% more moisture. It soaks the toughest whiskers soft-extra soft-so they come off clean as a whistle.

You get a smooth-as-silk shave that lasts all day. And it soother and protects the skin while you shaveleaves it soft, pliant, refreshed afterward. Economical, too - a little goes so far. Try it. Get the big red tube at your druggist's. Or write for a free trial rube to Lever Brothers Co., Dept. '-145, Cambridge, Mass. (Thi) offer good in U.S. and Canada only.)

BURNING OVEN

STEAKS COOK BUT THE MAN LIVES . .



IT'S FUN TO BE FOOLED ...IT'S MORE FUN TO KNOW

the "fire" king, M. Chabert, earrying several raw steaks. A few minutes later the doors were flung wide and out he stepped...sale and sound ... with the steaks thoroughly cooked. **EXPLANATION:**

600° F. Into the oven walked

Heat rises, When Chabert entered the over he bung the straks above the fire, then dropped to the floor at the zide, covering his head with a hood made fromhis shirt. He breathed through

small air holes is the firms,

"The Burning Oven" is an old illusion which has played a leading role in eigarette advertising, Its modern name is "Heat Treatment."

EXPLANATION: All cigarette manufacturers use heat treatment. The first Camel eigarette was manufactured under the heat-treating process. Every one of the billions of Camels produced since has received the necessary heat treatment.

Harsh, raw tobaccos require intensive processing under high temperatures. The more expensive tobaccos, which are naturally mild, call for only a moderate application of heat,

It is a fact, well known by leaf tobacco experts, that Camels are made from finer, MORE EXPENSIVE tobaccos than any other popular brand.

Try Camels...always fresh, in the air-tight, welded Humidor Pack.

NO TRICKS ... JUST COSTLIER **TOBACCOS**

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